Blue Earth County, Minnesota
All-Hazard Mitigation Plan
2013 Update

BLUE EARTH
COUNTY

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All-Hazard Mitigation Plan
2013 Update

Adoption Date: _____

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1.0 INTRODUCTION

1.1 HAZARD MITIGATION[1]

The Federal Emergency Management Agency (FEMA) defines "Hazard Mitigation" as sustained action to reduce or eliminate long-term risk to human life and property from natural hazards and their effects. Hazard mitigation activities may be implemented prior to, during, or after an event. However, it has been demonstrated that hazard mitigation is most effective when based on an inclusive, comprehensive, long-term plan that is developed before a disaster occurs. This definition distinguishes actions that have a long-term impact from those that are more closely associated with immediate preparedness, response, and recovery. Hazard mitigation is the only phase of emergency management specifically dedicated to breaking the cycle of damage, reconstruction, and repeated damage.

1.2 BLUE EARTH COUNTY MULTI-JURISDICTIONAL HAZARD MITIGATION PLAN[2]

This document, the Blue Earth County All-Hazard Mitigation Plan, is a multi-jurisdictional plan. A multi-jurisdictional plan is a plan jointly prepared by more than one jurisdiction, or local government entity (county, city, and township). There are many benefits to local jurisdictions by utilizing this joint planning process:

- Identifying mitigation strategies for hazards that affect multiple jurisdictions
- Leveraging individual jurisdictional capabilities and sharing of costs/resources
- Avoiding duplication of efforts
- Recognition that a hazard's impact crosses jurisdictional boundaries.

A full list of jurisdictions is provided below.

Figure 1-1: Participating Jurisdictions

Cities	Townships	
Amboy	Beauford	Mankato
Eagle Lake	Butternut Valley	Mapleton
Good Thunder	Cambria	Medo
Lake Crystal	Ceresco	Pleasant Mound
Madison Lake	Danville	Rapidan
Mankato	Decoria	Shelby
Mapleton	Garden City	South Bend
Pemberton	Jamestown	Sterling
St. Clair	Judson	Vernon Center
Skyline	LeRay	
Vernon Center	Lime	
	Lincoln	
	Lyra	
	McPherson	

1.3 LEGAL AUTHORITY & JUSTIFICATION

1.3.1 DISASTER MITIGATION ACT OF 2000

The Disaster Mitigation Act of 2000 (DMA 2000), also known as Public Law 106-390, provides the legal basis for FEMA mitigation planning requirements for State, local and Tribal governments as a condition of mitigation grant assistance. The DMA 2000 amended the Robert T. Stafford Disaster Relief and Emergency Assistance Act of 1988 (which had amended the Disaster Relief Act of 1974) by repealing the previous mitigation planning provisions and replacing them with a new set of requirements that emphasize the need for State, local, and Tribal entities to closely coordinate mitigation planning and implementation efforts. Under the DMA 2000, local plans are required to 1). describe actions to mitigate hazards, risks, and vulnerabilities identified under the plan; and 2). establish a strategy to implement those actions.

1.3.2 44 CFR §201.6

The Code of Federal Regulations Title 44 Chapter 201 Section 6 addresses "Local Mitigation Plans". This section requires that local governments seeking funding from four out of the five mitigation assistance programs must have a FEMA authorized local hazard mitigation plan. The only program that does not require a local mitigation plan is the Repetitive Flood Claims program (see 1.4.1.D below).

1.3.2.A. PLAN UPDATE REQUIREMENT

44 CFR §201.6 also requires that local jurisdictions must review and revise their plans to reflect changes in development, progress in local mitigation efforts, and changes in priorities, and resubmit it for approval within five years in order to maintain eligibility for mitigation project grant funding.

1.3.3 GOVERNOR'S EXECUTIVE ORDER 11-03

The Minnesota Governor's Executive Order 11-03 clarified the roles and responsibilities of state agencies in emergencies. The Department of Homeland Security and Emergency Management was assigned overall responsibility for coordinating the development and maintenance of the all-hazard Minnesota Emergency Operations Plan.

1.3.4 MINNESOTA STATE STATUTES, CHAPTER 12.09

Chapter 12, Section 9, Subdivision 7 of the 2011 Minnesota State Statutes dictates that the Division of Emergency Management shall develop and maintain a comprehensive hazard mitigation plan for this state, with the plan integrated into and coordinated with the hazard mitigation plans of the federal government to the fullest possible extent. The division shall coordinate the preparation of hazard mitigation plans by the political subdivisions, with the plans integrated into and coordinated with the hazard mitigation plan of this state to the fullest possible extent.

1.3.5 MINNESOTA STATE STATUTES, CHAPTER 394.21

Chapter 394, Section 21, Subdivision 1 of the 2011 Minnesota State Statutes dictates that any county in the state having less than 300,000 population according to the 1950 federal census is authorized to carry on county planning and zoning activities for the purpose of promoting the health, safety, morals, and general welfare of the community.

1.4 FEDERAL HAZARD MITIGATION ASSISTANCE

FEMA's Hazard Mitigation Assistance (HMA) programs present an opportunity to reduce or eliminate the risk to human life and property from natural hazards, while simultaneously reducing reliance on Federal disaster funds through hazard mitigation planning and project grant funding. Under the DMA 2000 (see 1.3.1 above) local jurisdictions are required to take part in the preparation and adoption of a hazard mitigation plan as a condition for receiving the non-emergency disaster assistance offered through HMA programs. Only one of the five HMA programs does not include this requirement: the Repetitive Floods Claim Program.

At the Federal level, FEMA administers the HMA programs, for which states (the applicant) apply for funding on behalf of local jurisdictions (the sub-applicant). At the state level, in Minnesota, all HMA programs are administered by the Department of Public Safety's Division of Homeland Security and Emergency Management (HSEM). HSEM State Hazard Mitigation Officers oversee all aspects of the programs, including: applications for funding, management of grant awards, and state approval of local mitigation plans. The Department of Natural Resources (DNR), as the agency responsible for implementation of the National Flood Insurance Program (NFIP), is also involved in mitigation efforts.

There are five HMA programs: the Hazard Mitigation Grant Program, Pre-Disaster Mitigation, Flood Mitigation Assistance, Repetitive Flood Claims, and Severe Repetitive Loss. A summary of the various HMA programs is provided below. Each HMA program was authorized by separate legislative action, and as such, each program differs slightly in scope and intent. Projects funded through an HMA program must demonstrate a positive cost-benefit ratio (i.e. the future benefits are equal to, or greater than, the cost of the project).

1.4.1 HAZARD MITIGATION ASSISTANCE PROGRAMS

1.4.1.A. HAZARD MITIGATION GRANT PROGRAM

The Hazard Mitigation Grant Program (HMGP) is designed to ensure that the opportunity to take critical mitigation measures to reduce the risk of loss of life and property from future disasters is not lost during the immediate reconstruction and recovery process following a disaster. HMGP is available, when authorized under a Presidential major disaster declaration, in the areas of the State requested by the Governor. The amount of HMGP funding available to the applicant is based upon the estimated total Federal assistance to be provided by FEMA for disaster recovery under the disaster declaration. The HMGP is authorized under Section 404 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act, as amended (the Stafford Act), Title 42 United States Code (U.S.C.) 5170c.

1.4.1.B. PRE-DISASTER MITIGATION PROGRAM

The Pre-Disaster Mitigation (PDM) program is designed to assist States and local jurisdictions to implement a sustained pre-disaster natural hazard mitigation program to reduce the overall risk to human life and structures from future hazard events, while also reducing reliance on Federal funding from future disasters. The PDM program is authorized under Section 203 of the Stafford Act, 42 U.S.C. 5133.

1.4.1.C FLOOD MITIGATION ASSISTANCE PROGRAM

The Flood Mitigation Assistance (FMA) program is designed to reduce or eliminate the long-term risk of flood damage to properties insured under the NFIP. The FMA program is authorized under Section 1366 of the National Flood Insurance Act of 1968, as amended (NFIA), 42 U.S.C. 4104c.

1.4.1.D REPETITIVE FLOOD CLAIMS PROGRAM

The Repetitive Flood Claims (RFC) program is designed to reduce flood damage to individual properties for which one or more claim payments for losses have been made under flood insurance coverage and that will result in the greatest savings to the National Flood Insurance Fund (NFIF) in the shortest period of time. The RFC program is authorized under Section 1323 of the NFIA, 42 U.S.C. 4030.

1.4.1.E. SEVERE REPETITIVE LOSS PROGRAM

The Severe Repetitive Loss (SRL) Pilot program is designed to reduce flood damages to residential properties that have experienced severe repetitive losses under flood insurance coverage and that will result in the greatest savings to the NFIF in the shortest period of time. The SRL is authorized under Section 1361A of the NFIA, 42 U.S.C. 4102a.

1.4.2 PROGRAM FUNDING SOURCES

The NFIF provides funding for FMA (Flood Mitigation Assistance), RFC (Repetitive Flood Claims), and SRL (Severe Repetitive Loss) programs. The PDM (Pre-Disaster Mitigation), FMA, RFC, and SRL programs are subject to the availability of appropriation funding, as well as any program specific directive or restriction made with respect to such funds.

1.4.3 COST SHARING

Under the HMA programs, the total cost to implement approved mitigation activities is generally funded by a combination of Federal and non-Federal sources. Both the Federal and the non-Federal shares must be eligible costs used in direct support of approved activities under the grant award. Contributions of cash, third party in-kind services or materials, or any combination thereof, may be accepted as part of the non-Federal cost share. For FMA, no more than half of the non-Federal contribution may be from third party in-kind contributions. In general, HMA funds may be used to pay up to 75 percent of the eligible activity costs; the remaining 25 percent of eligible activity costs are derived from non-Federal resources. Exceptions to the 75/25 cost share are shown in Figure 1-2 below.

Figure 1-2: HMA Program Cost Share Ratios

Programs	Mitigation Activity (Percent of Federal/Non-Federal Share)
HMGP	75/25
PDM	75/25
PDM - subgrantee is small impoverished community	90/10
PDM - Tribal Grantee is small impoverished community	90/10
FMA	75/25
FMA - severe repetitive loss of property with Repetitive Loss Strategy	90/10
RFC	100/0
SRL	75/25
SRL - with Repetitive Loss Strategy	90/10

1.5 ELIGIBLE HAZARD MITIGATION ASSISTANCE PROJECTS

Projects eligible for Hazard Mitigation Assistance (HMA) are described in the FY2011 Hazard Mitigation Assistance Unified Guidance.[3] This document consolidates the common requirements for all HMA programs and explains the unique elements of the programs in individual sections. Additionally, it provides assistance for Federal, State, Tribal, and local officials on how to apply for HMA funding for a proposed mitigation activity. The following is a summary of the eligible projects identified within the FY 2011 HMA Unified Guidance.

Figure 1-3: Hazard Mitigation Actions by Program

Eligible Activities	HMGP	PDM	FMA	RFC	SRL
Mitigation Projects	x	x	x	x	x
Property Acquisition and Structure Demolition	x	x	x	x	x
Property Acquisition and Structure Relocation	x	x	x	x	x
Structure Elevation	x	x	x	x	x
Mitigation Reconstruction	-	-	-	-	x
Dry Floodproofing of Historic Residential Structures	x	x	x	x	x
Dry Floodproofing of Non-residential Structures	x	x	x	x	x
Minor Localized Flood Reduction Projects	x	x	x	x	x
Structural Retrofitting of Existing Buildings	x	x	-	-	-
Non-structural Retrofitting of Existing Buildings and Facilities	x	x	-	-	-
Safe Room Construction	x	x	-	-	-
Infrastructure Retrofit	x	x	-	-	-
Soil Stabilization	x	x	-	-	-
Wildfire Mitigation	x	x	-	-	-
Post-Disaster Code Enforcement	x	x	-	-	-
5% Initiative Projects	x	-	-	-	-
Hazard Mitigation Planning	x	x	x	-	-
Management Costs	x	x	x	x	x

1.5.1 FLOOD MITIGATION PROJECTS

1.5.1.A. PROPERTY ACQUISITION & STRUCTURE DEMOLITION

Property acquisition and structure demolition projects involve the voluntary acquisition of an existing at-risk structure and, typically, the underlying land, and conversion of the land to open space through the demolition of the structure. The property must be deed-restricted in perpetuity to open space uses to restore and/or conserve the natural floodplain functions.

1.5.1.B. PROPERTY ACQUISITION & STRUCTURE RELOCATION

Property acquisition and structure relocation projects involve the voluntary physical relocation of an existing structure to an area outside of a hazard-prone area and, typically, the acquisition of the underlying land. Relocation must conform to all applicable State and local regulations. The property must be deed-restricted in perpetuity to open space uses to restore and/or conserve the natural floodplain functions.

1.5.1.C. STRUCTURE ELEVATION

Structure elevation projects involve physically raising an existing structure to the Base Flood Elevation (BFE) or higher if required by FEMA or local ordinance. Structure elevation may be achieved through a variety of methods, including elevating on continuous foundation walls; elevating on open foundations, such as piles, piers, posts, or columns; and elevating on fill. Foundations must be designed to properly address all loads and be appropriately connected to the floor structure above, and utilities must be properly elevated as well.

1.5.1.D. MITIGATION RECONSTRUCTION

Mitigation reconstruction projects involve the construction of an improved, elevated building on the same site where an existing building and/or foundation has been partially or completely demolished or destroyed. Mitigation reconstruction is only permitted for structures outside of the regulatory floodway or coastal high hazard area as identified by the existing best available flood hazard data. Activities that result in the construction of new living space at or above the BFE will only be considered when consistent with the mitigation reconstruction requirements. Such activities are only eligible under SRL.

1.5.1.E. DRY FLOODPROOFING

Dry floodproofing projects involve the application of techniques designed to keep structures dry by sealing the structure to keep floodwaters out.

1.5.1.F. MINOR LOCALIZED FLOOD REDUCTION PROJECTS

Minor localized flood reduction projects aim to lessen the frequency or severity of flooding and decrease predicted flood damages, such as the installation or modification of culverts and stormwater management activities (e.g. creating retention and detention basins). These projects must not duplicate the flood prevention activities of other Federal agencies and may not constitute a section of a larger flood control system.

1.5.2 FLOOD, EARTHQUAKE, & TORNADO MITIGATION PROJECTS

1.5.2.A. STRUCTURAL RETROFITTING OF EXISTING BUILDINGS

Structural retrofitting of existing buildings projects involves modifications made to the structural elements of a building to reduce or eliminate the risk of future damage and to protect inhabitants. The structural elements of a building that are essential to protect in order to prevent damage include: foundations, load-bearing walls, beams, columns, building envelope, structural floors and roofs, and the connections between these elements.

1.5.2.B. NON-STRUCTURAL RETROFITTING OF EXISTING BUILDINGS & FACILITIES

Non-structural retrofitting of existing buildings and facilities projects involves modifications made to the non-structural elements of a building or facility to reduce or eliminate the risk of future damage and to protect inhabitants. Non-structural retrofits may include bracing of building contents to prevent earthquake damage or the elevation of heating and ventilation systems.

1.5.2.C. SAFE ROOM CONSTRUCTION

Safe room construction projects are designed to provide immediate life-safety protection for people in public and private structures from tornado and severe wind events. For HMA, the term "safe room" only applies to extreme wind (combined tornado and hurricane) residential, non-residential, and community safe rooms; tornado community safe rooms; and hurricane community safe rooms. This type of project includes retrofits of existing facilities or new safe room construction projects, and applies to both single and multi-use facilities.

1.5.2.D. INFRASTRUCTURE RETROFIT

Infrastructure retrofit projects involve measures to reduce risk to existing utility systems, roads, and bridges.

1.5.2.E. SOIL STABILIZATION

Soil stabilization projects aim to reduce risk to structures or infrastructure from erosion and landslides, including installing geo-textiles, stabilizing sod, installing vegetative buffer strips, preserving mature vegetation, decreasing slope angles, and stabilizing with rip rap and other means of slope anchoring. These projects must not duplicate the activities of other Federal agencies.

1.5.3 WILDFIRE MITIGATION PROJECTS

1.5.3.A. DEFENSIBLE SPACE FOR WILDFIRE

Defensible space for wildfire projects involves the creation of perimeters around homes, structures, and critical facilities through the removal or reduction of flammable vegetation.

1.5.3.B. APPLICATION OF IGNITION-RESISTANT CONSTRUCTION

Application of ignition-resistant construction projects involve the application of ignition resistant techniques and/or non-combustible materials on new and existing homes, structures, and critical facilities.

1.5.3.C. HAZARDOUS FUELS REDUCTION

Hazardous fuels reduction projects involve the removal of vegetative fuels near to the at-risk structure that, if ignited, pose significant threat to human life and property, especially critical facilities.

1.5.4 ALL-NATURAL HAZARD MITIGATION PROJECTS

1.5.4.A. POST-DISASTER CODE ENFORCEMENT

Post-disaster code enforcement projects are designed to support the post-disaster rebuilding effort by ensuring that sufficient expertise is on hand to ensure appropriate codes and standards are utilized and enforced.

1.5.4.B. 5% INITIATIVE PROJECTS

Five percent initiative projects provide an opportunity to fund mitigation actions that are consistent with the goals and objectives of the State and local mitigation plans and that meet all HMGP program requirements, but for which it may be difficult to conduct a standard Benefit Cost Analysis to prove cost effectiveness.

1.5.4.C. HAZARD MITIGATION PLANNING

Mitigation plans are the foundation for effective hazard mitigation. A mitigation plan is a demonstration of the commitment to reduce risks from natural hazards and serves as a strategic guide for decision makers as they commit resources.

2.0 PREREQUISITES

This updated plan has been prepared in accordance with the requirements of the Disaster Mitigation Act of 2000 with the intention that it be adopted by the county and each incorporated jurisdiction subsequent to State and Federal approval.

2.1 MULTI-JURISDICTIONAL PLAN ADOPTION

After HSEM and FEMA review the plan and approve it "pending local adoption" the Blue Earth County hazard mitigation planning team will present the plan to the county and city officials of each jurisdiction for adoption. Resolutions and adoption dates are included in Appendix 8.1 of this plan.

2.2 JURISDICTIONAL PARTICIPATION

All incorporated jurisdictions participated in the review and update of the Blue Earth County All-Hazard Mitigation Plan. All cities that participated in the initial 2008 plan participated in the 2013 update, see Figure 2-1 below. Township involvement was not required as part of the planning process and therefore their adoption of the plan is not required. Townships are covered under the county's adoption of the plan.

Figure 2-1: Jurisdiction Participation

Jurisdiction Name	Hazard Identification	Risk Assessment	Mitigation Strategies
Blue Earth County	✓	✓	✓
City of Amboy	✓	✓	✓
City of Eagle Lake	✓	✓	✓
City of Good Thunder	✓	✓	✓
City of Lake Crystal	✓	✓	✓
City of Madison Lake	✓	✓	✓
City of Mankato	✓	✓	✓
City of Mapleton	✓	✓	✓
City of Pemberton	✓	✓	✓
City of St. Clair	✓	✓	✓
City of Skyline	✓	✓	✓
City of Vernon Center	✓	✓	✓

3.0 PLANNING PROCESS

Blue Earth County utilized Region Nine Development Commission (RNDC) for the five year update of this mitigation plan. The county and RNDC worked together to access resources from the Minnesota Department of Public Safety's Homeland Security and Emergency Management Division. The planning process was organized by a steering committee made up of Blue Earth County and Region Nine Development Commission staff.

- **Evaluate Hazards**

Region Nine Development Commission gathered data and historical information regarding hazards in Blue Earth County. A comprehensive list of hazards was developed from the existing Blue Earth County Hazard Mitigation Plan, the State of Minnesota Hazard Mitigation Plan, and FEMA/HSEM resources. Cities and townships were surveyed (see Appendix 8.2). Each of the city/township governing boards was presented background information on hazard mitigation, terminology definitions, and the plan updating process during a work-session. They were asked to complete a survey updating their vulnerability to hazards. Each jurisdiction was additionally asked to denote, on a plotted map, the locations of critical facilities, potential development areas, and hazard areas.

- **Risk Assessment**

Information from the surveys completed by the cities/townships was compiled. A vulnerability analysis was completed with the information from the survey and from research completed by Region Nine Development Commission.

- **Countywide Open House**

On November 14, 2012 the county hosted a Hazard Mitigation Open House at the Minnesota National Guard Armory in Mankato. The hazard probability and impact for each jurisdiction was on display along with informational booths on the Rapidan Dam, erosion issues, severe weather, and flooding. The public had the opportunity to discuss the hazards with experts stationed at the booth and complete a survey outlining their concern specific to a particular hazard.

- **Develop Mitigation Strategies**

Each local jurisdiction was asked to submit potential mitigation strategies in their survey. After Region Nine Development Commission and the county reviewed the survey materials, each of the jurisdictions was provided additional mitigation strategies for consideration. The additional mitigation strategies were selected from FEMA/HSEM resources, ideas submitted from one jurisdiction that needed to be shared with the local jurisdictions, and ideas from local hazard experts.

The existing mitigation strategies from the previous plan were reviewed by the Stakeholder Taskforce. Upon completion of the review, the previous mitigation strategies were

integrated into the new strategies drawn from the survey and combined from the comprehensive list of mitigation actions found in Section 6 of this plan.

- **Review and Local Adoption**

Upon completing the Mitigation Strategies section, Region Nine Development Commission and the county reviewed the plan in its entirety. After changes from this review were incorporated it was sent on to HSEM for state level approval. After this approval the plan was sent to FEMA and local adoption occurred after FEMA returned the plan.

3.1 STEERING COMMITTEE

A Steering Committee was created to oversee and guide the update planning process. The Committee consisted of representatives from the County and Region Nine Development Commission, as the project consultant. Steering Committee members are listed in Figure 3-1below.

Figure 3-1: Steering Committee Members

Name	Position	Representing
Al Kluever	Deputy Emergency Management Coordinator	Blue Earth County
John Considine	Department Coordinator	Region Nine Development Commission
Jon Hammel	Department Planner	Region Nine Development Commission
Isaac Kerry	Department Specialist	Region Nine Development Commission

3.2 STAKEHOLDER TASKFORCE

A stakeholder taskforce was assembled to provide wider representation from the public/education, county and cities within Blue Earth County. The responsibility of the stakeholder taskforce was to provide input and information throughout the planning process. The Figure 3-2 below lists all stakeholders who were asked to participate in this planning process.

Figure 3-2: Stakeholder Taskforce Members

Name	Position	Organization	Role
Scott Walter	Director of Network Services	Hickory Tech	Broadcasting Corporation
Tim Block	Mankato Manager	Charter	Broadcasting Corporation
Gregorio Mendez-Ortega	Ag Chemical Advisor	Minnesota Department of Agriculture	Chemical/Ag
Matt Thompson	Hazardous Materials Manager	Union Pacific	Commercial Transportation
Terry Overn	Environmental Services	SMC	Construction
Carol Jensen	Assistant Director	MNSU,M Facilities	Education
Paul Zunkel		MNSU,M Geography Department	Education, Weather Consultant

Name	Position	Organization	Role
Rachel Kruger	Operations Cooridnator	Red Cross	Emergency Response
John Kitmann	Environmental Coordinator	ADM	Food Processing Plant
Jason Trask	Compliance	CHS	Food Processing Plant
Amanda Storlien		CHS	Food Processing Plant
Kevin Burns	Public Information/Communications	ISJ	Health Care
Jerad Bach	District Manager	Soil and Water Conservation District	Local Expert
Heather Spann	Administrative Assistant	Salvation Army	Nonprofit
Jon Moldstad	Security Director	Bethany College	Private Education
Paul Wilke	Senior General Manager	River Hills Mall	Retail
Tom Bruels	Superintendent	St. Clair Schools	School Expert
Willis Schoeb	Superintendent	Maple River Schools	School Expert
Les Norman	Superintendent	Lake Crystal-Welcome Memorial Schools	School Expert
Joe Meixl	Environmental Coordinator	District 77 Schools	School Expert
Leo Getsfried	Area Hydrologist	Department of Natural Resources	State Expert
Rebecca Arndt	Public Affairs coordinator	Minnesota Department of Transportation	State Expert
Archie Kendall	Manager	Benco	Utility
Noel Hibbard		Centerpoint	Utility
Dave Bever	Koch Manager	Koch/Enterprise	Utility
Ryan Weise	Manager	Rapidan Dam	Utility
Larry Novak		Xcel	Utility
Rick Bondy		Magellan Midstream Partners, LLC	Utility
Dave Jacobs	Plant Manager	Calpine Natural Gas	Utility
Dan Munthe	Pipeline Compliance	Alliance Pipeline	Utility
Greg Suskovic	District Veterinarian	Minnesota Board of Animal Health	Vet/Ag
Lynn Brown	Corporate Communications Vice President	Waste Management	Waste Removal
Tom Froelich	Manager	Ponderosa Landfill	Waste Removal
Ryan Braulick	District Conservationist	USDA-NRCS	
Mark Piepho	County Commissioner	Blue Earth County	County Leadership
Drew Campbell	County Commissioner	Blue Earth County	County Leadership
Kip Bruender	County Commissioner	Blue Earth County	County Leadership
Will Purvis	County Commissioner	Blue Earth County	County Leadership
Vance Stuehrenberg	County Commissioner	Blue Earth County	County Leadership
George Leary	Land Use Administrator	Blue Earth County	County Technical Expert
Julie Conrad	Environmental Services	Blue Earth County	County Technical Expert

Name	Position	Organization	Role
Scott Salsbury	Land Use Planner/Mapping	Blue Earth County	County Technical Expert
Al Kluever	Deputy Emergency Management Coordinator	Blue Earth County	County Technical Expert
Brenda Olmscheid	Asst. Emergency Management Director	Blue Earth County	County Technical Expert
Jessica Potter	Executive Director	Blue Earth County Historical Society	County Technical Expert
Jessica Beyer	Public Information Officer	Blue Earth County	County Technical Expert
Al Forsberg	Public Works Director	Blue Earth County	County Technical Expert
Kelly Haeder	Public Health Director	Blue Earth County	County Technical Expert
Mike Maurer	Emergency Manager	Blue Earth County Sherriff's Office	County Technical Expert
Kathy Ikier	City Clerk	Amboy	City Leadership
Cheryl Barnard	City Clerk and Treasurer	Good Thunder	City Leadership
Robert Hauge	City Administrator	Lake Crystal	City Leadership
Patty Woodruff	City Administrator	Mapleton	City Leadership
Darla Ward	City Clerk	Pemberton	City Leadership
Patricia Krosch	City Clerk	Vernon Center	City Leadership
Catherine Seys	City Clerk	St Clair	City Leadership
Kelly Steele	City Clerk	Madison Lake	City Leadership
Mike Kluck	Mayor	Skyline	City Leadership
Sack Thongvanh	City Administrator	Eagle Lake	City Leadership
Rick Reinbold	Public Works Director	Eagle Lake	City Technical Expert
Chris Roemhildt	Public Works Director	Madison Lake	City Technical Expert
Roger Hermanson	Fire Chief	Skyline	City Technical Expert
Matt Westermayer	Public Safety Deputy Director Police	City of Mankato	City Technical Expert
Trudy Kunkel	City of Mankato Emergency Manager	City of Mankato	City Technical Expert
Shelly Schultz	Public Information/Communications	City of Mankato Public Information	City Technical Expert
Mark Knoff	Public Works Director	Mankato Public Works	City Technical Expert
Paul Vogel	Community Development Director	Mankato Community Development	City Technical Expert
Dan Sarff	Engineering	Bolton and Menk	City/Township Expert
Kim Krengel	Clerk	Beauford Township	Township Leadership
Mary Hylen	Clerk	Butternut Valley Township	Township Leadership
Joel Fishcher	Supervisor	Cambria Township	Township Leadership
Tammy/Dean Sonnabend	Clerk/Treasurer	Ceresco Township	Township Leadership
Sarah Schwarz	Treasurer	Danville Township	Township Leadership
Valerie Levos	Clerk	Decoria Township	Township Leadership
Liz Brown	Clerk	Garden City Township	Township Leadership
Jim Anderson	Clerk	Jamestown Township	Township Leadership

Name	Position	Organization	Role
Brad Anderson	Clerk	Judson Township	Township Leadership
Karyn Block	Clerk	Leray Township	Township Leadership
Robert Fitterer	Clerk	Lime Township	Township Leadership
LaVola Lewis	Clerk	Lincoln Township	Township Leadership
Sandra Miller	Clerk	Lyra Township	Township Leadership
Dan Fogal	Clerk	Mankato Township	Township Leadership
C. Kay Proehl	Clerk/Treasurer	Mapleton Township	Township Leadership
Steve More	Treasurer	McPherson Township	Township Leadership
Sandy Hooker	Chair	Medo Township	Township Leadership
Dennis Urban	Clerk	Pleasant Mound Township	Township Leadership
Maria Bartsch	Clerk/Treasurer	Rapidan Township	Township Leadership
John T. Mack	Clerk	Shelby Township	Township Leadership
Steven B. Flo	Clerk/Treasurer	South Bend Township	Township Leadership
Judy Conrad	Clerk	Sterling Township	Township Leadership
Jim Johnson	Supervisor	Sterling Township	Township Leadership
Jeff Hohenstein	Supervisor	Vernon Center Township	Township Leadership

3.3 PUBLIC INVOLVEMENT

An effort was made to solicit public input during the planning process through multiple methods. The Stakeholder Taskforce discussed in the previous section targeted public input from stakeholders who could have an interest in hazard mitigation. Additional efforts were made at different points in the planning process.

3.3.1 CITY AND TOWNSHIP INDIVIDUAL COMMUNITY STAKEHOLDER SURVEY

During 2011, Blue Earth County and Region Nine Development Commission (RNDC) staff went to each of the 23 townships boards and 11 city councils within the county. Staff presented background information on hazard mitigation, terminology definitions, and the plan updating process.

Each jurisdiction was asked to complete a survey. In addition to the jurisdictional survey, county and RNDC staff provided an Individual Community Survey which could be disseminated to the general public. Each jurisdiction was asked to get at least 6 surveys completed from the public. The survey evaluated the perceived probability and impact of hazards on the local jurisdiction. An example of the survey can be found in Appendix 8.2.

The county received 89 Individual Community Stakeholder Survey responses. Participants were asked to rate the probability and impact on a scale of 1 to 3 (1 - minimal, 2 - moderate, 3 - significant). The results of the survey are found in section 5.2.7. These results were incorporated into the County Vulnerability Analysis found in Risk Assessment section of this plan.

3.3.2 COUNTYWIDE OPEN HOUSE

On November 14, 2012 the county hosted a Hazard Mitigation Open House at the Minnesota National Guard Armory in Mankato. The county publicized the event through the bi-annual newsletter and email correspondence with those on the Hazard Mitigation Stakeholder Taskforce. The event presented information on hazards impacting the county. The results of the survey completed by cities/townships evaluating the hazard probability and impact were on display along with other information on the Rapidan Dam, erosion issues, severe weather, and flooding. The public was encouraged to ask questions of the experts stationed at each display.

Dr. Mark Seeley was present at the open house meeting. Dr. Seeley is a professor in the Department of Soil, Water, and Climate at the University of Minnesota where he has worked since 1978. His extension educational programs relate weather/climate impacts to Minnesota agriculture, transportation, energy, tourism, and natural resources. He has published two books about Minnesota's weather and climate and has been awarded the Sigma Xi Science Communication and Education Award, the Mn/DOT Research Partnership Award for his work with the deployment of living snow fences, the Extension Director's Award for Distinguished Faculty, and most recently the University of Minnesota President's Award for Outstanding Service.[4]

3.3.3 PUBLIC REVIEW

Upon completion of a draft document, the Hazard Mitigation plan was placed on the Blue Earth County website for a full public review. Comments received during this review were incorporated into the final plan.

4.0 COUNTY PROFILE

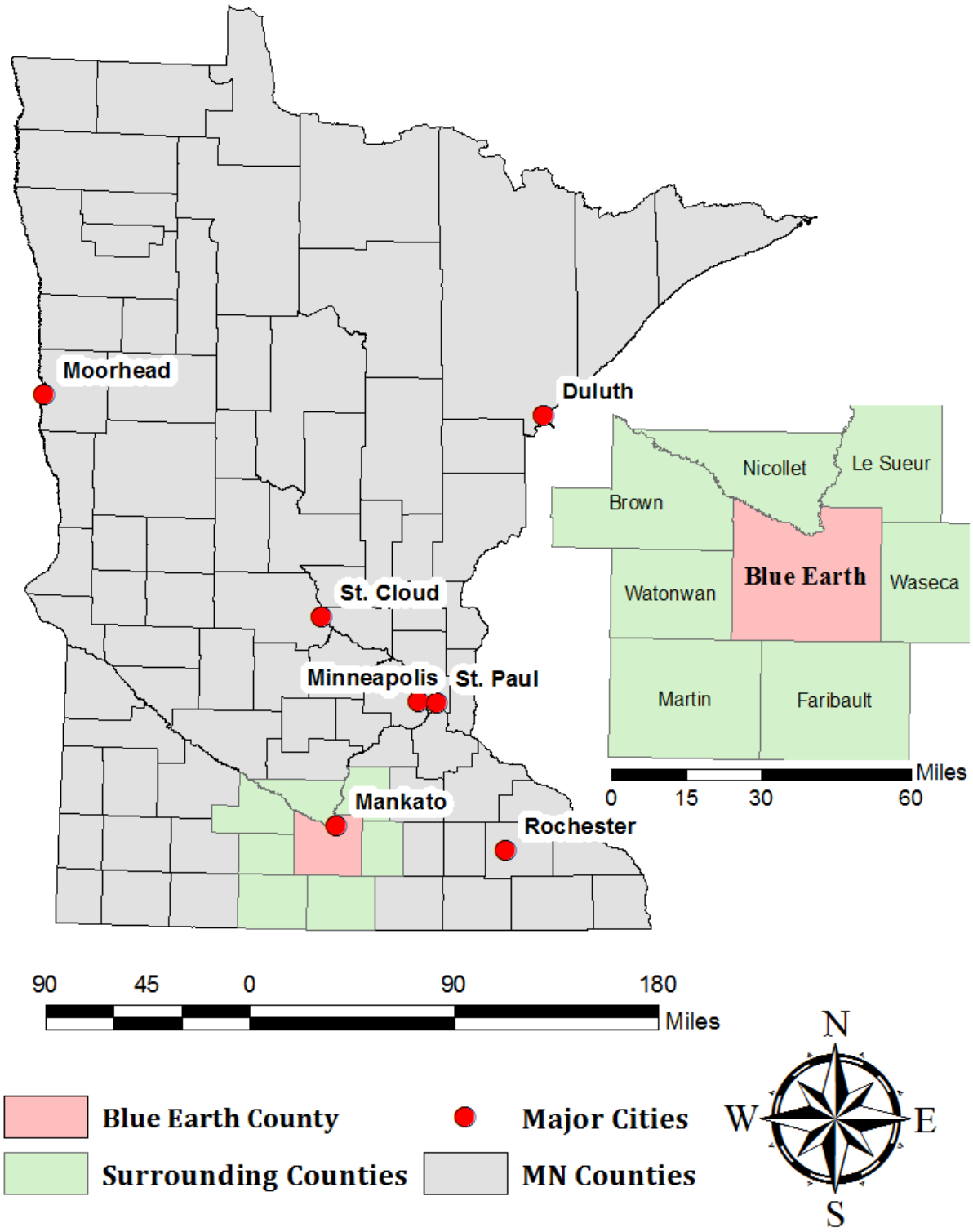
4.1 LOCATION

Blue Earth County is located in South Central Minnesota approximately 70 miles southwest of the Minneapolis St Paul metropolitan area. There are 34 subdivisions (Cities or Townships) within the County:

1. City of Amboy
2. Beauford Township
3. Butternut Valley Township
4. Cambria Township
5. Ceresco Township
6. Danville Township
7. Decoria Township
8. City of Eagle Lake
9. Garden City Township
10. City of Good Thunder
11. Jamestown Township
12. Judson Township
13. City of Lake Crystal
14. LeRay Township
15. Lime Township
16. Lincoln Township
17. Lyra Township
18. McPherson Township
19. City of Madison Lake
20. Mankato Township
21. City of Mankato
22. Mapleton Township
23. City of Mapleton
24. Medo Township
25. City of Pemberton
26. Pleasant Mound Township
27. Rapidan Township
28. City of St. Clair
29. Shelby Township
30. City of Skyline
31. South Bend Township
32. Sterling Township
33. Vernon Center Township
34. City of Vernon Center

The County's only natural physical boundary is the Minnesota River which flows along its northern border. Nicollet County is located on the other side of the Minnesota River to the north, Waseca County is located to the east, Brown/Watonwan Counties are located to the west, and Martin/Faribault Counties are located to the south. The land area of the County is approximately 752 square miles or roughly 481,000 acres.[5]

Figure 4-1: Blue Earth County Minnesota



4.2 TOPOGRAPHY

The topography and physical characteristics of Blue Earth County have extensive variety. The major part of the County is an elevated plain, draining northward through tributaries of the Minnesota River that converge toward the City of Mankato. There they break the continuity of the plain with rather sharp, deep valleys, of which the valleys of the Blue Earth and Le Sueur Rivers are typical. Most of the plain lies between 1,000 and 1,110 feet above sea level. Except for the major valleys, the surface is flat to gently rolling and marked by numerous broad, shallow depressions with poorly drained marshes. The larger streams are characterized by a series of terraces. At Mankato and northward, for example, the quarry district is loaded on such a terrace, while the City of Mankato itself lies on a low alluvial terrace.

When examining a topographic map of Blue Earth County, the presences of two main physiographic zones become obvious:

- The floodplain is located primarily along the Minnesota River, where it forms the northern boundary of the County. In addition, extensive flood plains also exist in the Mankato vicinity. Although there are many rivers and streams within the County, their associated valleys are quite narrow with steep bluffs and consequently very little floodplain; and

- The upland plain occupies the major portion of the County and is composed of the surface mantle. The plain is dissected by numerous streams and rivers but is comprised of flat to gently rolling topography. This is due to the relative immaturity of the rivers while there is a relatively good supply of water in the mantle, the very large supplies are found in the strata below the surface layer. [6]

4.3 CLIMATE

The Blue Earth County area has one of the most favorable climates in the world for growing crops. The summers are quite warm and the maximum rainfalls occur in the spring and early summer when the crops require it most. Late summer and autumn are generally dry, contributing to the maturation and easy harvesting of crops.

To speak of average temperatures is somewhat meaningless, but to point out that the temperature can drop to -37° F or hit peaks of 108 ° F, is possibly one of the most pertinent facts of temperature in the County. The affects from this wide range in temperatures impact primarily construction activities, vegetation, and wildlife. The mean annual temperature is 46 ° F, with July being the warmest month averaging 72° F, and January being the coldest month averaging 16 ° F.

Other pertinent climatic conditions of Blue Earth County are as follows:

- Average annual rainfall 28 inches
- Average snowfall 35 inches
- Average relative humidity 70%

- ❖ Average annual temperature range 118° F
- ❖ Average period between killing frosts 140 days
- ❖ Average annual wind velocity 9.6mph

Wind direction and intensity should be considered for proper placement of land uses which produce offensive odors or excessive smoke or dust. This simply means that during the planning stage, thought should be given to the location of uses, such as feedlots and certain industries, in relation to the population and public facilities.[7]

4.4 DEMOGRAPHICS

Blue Earth County has a 2010 population of 64,013.[8] From 2000–2010, Blue Earth County experienced a population increase of 14.4%. Below is a detailed table of the County's changes in population from 1990 to 2010.

Figure 4-2: County Population Change[9]

1990	2000	2010	Change 1990-2000	% Change 1990-2000	Change 2000-2010	% Change 2000-2010	2010 Minority Population	% Minority
54,044	55,941	64,013	1,897	3.50%	8,072	14.40%	5,619	8.80%

The 34 county subdivisions' populations are presented in the table below.

Figure 4-3: Population Change by County Subdivision[10]

County Subdivision	2010	2000	% Change
City of Amboy	534	588	-10.1%
Beauford Township	406	471	-16.0%
Butternut Valley Township	325	362	-11.4%
Cambria Township	260	307	-18.1%
Ceresco Township	239	228	4.6%
Danville Township	240	252	-5.0%
Decoria Township	1104	918	16.8%
City of Eagle Lake	2422	1779	26.5%
Garden City Township	689	739	-7.3%
City of Good Thunder	583	606	-3.9%
Jamestown Township	693	622	10.2%
Judson Township	554	581	-4.9%
City of Lake Crystal	2549	2406	5.6%
LeRay Township	746	860	-15.3%
Lime Township	1395	1304	6.5%
Lincoln Township	200	198	1.0%

County Subdivision	2010	2000	% Change
Lyra Township	327	348	-6.4%
McPherson Township	466	515	-10.5%
City of Madison Lake	1017	822	19.2%
Mankato Township	1969	1869	5.1%
City of Mankato	39305	32357	17.7%
Mapleton Township	310	309	0.3%
City of Mapleton	1756	1674	4.7%
Medo Township	364	390	-7.1%
City of Pemberton	247	223	9.7%
Pleasant Mound Township	214	274	-28.0%
Rapidan Township	1101	1069	2.9%
City of St. Clair	868	802	7.6%
Shelby Township	265	286	-7.9%
City of Skyline	289	371	-28.4%
South Bend Township	1682	1473	12.4%
Sterling Township	296	272	8.1%
Vernon Center Township	262	340	-29.8%
City of Vernon Center	332	326	1.8%

4.5 ECONOMY

Blue Earth County has unique labor force statistics. As seen in the data sets in the table below, the County ranks #1 in the state in terms of available labor force per capita. Additionally, it has the highest rate of poverty among its labor force. However, this does not accurately reflect the county's economy and is most likely a result of having a high population of students attending higher education institutions. The economic vitality of the County is reflected in the 13th lowest unemployment rate in the state and 8th highest educated population.

Figure 4-4: County Economic Profile[11]

Data Set	Time Period	#	County Rank within State
Working Age (18-64) population (% of total)	2006-2010 Average 2010	69.20%	1
Population(> 24) with more than a HS diploma (%)	2006-2010 Average 2010	93.00%	8
Pop. speaks English less than "very well" (%)	2006-2010 Average 2010	2.20%	23
Labor Force	Apr-12	39,053	13
Per capita income (dollars)	2006-2010 Average 2010	$23,691	54
Employment, Annual Average	Annual 2011	36,931	10

Data Set	Time Period	#	County Rank within State
Employment, Quarter Average	Fourth Quarter 2011	37,745	10
Employment Change from Year Prior	Fourth Quarter 2011	392	NA
Mean travel time to work (minutes)	2006-2010 Average 2010	17	69
Projected Employment Change (#)	Long-term Projections 2019	N/A	NA
Projected Employment Change (%)	Long-term Projections 2019	N/A	NA
Number Unemployed	Apr-12	1,623	71
Unemployment Rate	Apr-12	4.20%	13
Population (18-64) below poverty (%)	2006-2010 Average 2010	20.70%	1
Initial Claims for Unemployment Insurance	Apr-12	160	64
Initial Claims Change from Year Prior	Apr-12	-20%	31
Job Vacancies	Fourth Quarter 2011	N/A	NA
Average Weekly Wage	Annual 2011	$679	30
Median Hourly Wage for All Employees	First Quarter 2012	N/A	

Blue Earth County has a heavy concentration in the Trade, Transportation and Utilities Super Sector (23.9%) and Education and Health Services Super Sector (30.3%) as of 2011. This is reflective of the City of Mankato serving as a regional hub for Southern Minnesota in these areas and the presence of Mayo Health Systems and multiple higher education institutions.

Figure 4-5: 2011 Employment by Industry Sector[12]

Sector	Percent of Total Workforce
Natural Resources and Mining	1.1%
Construction	4.5%
Manufacturing	9.7%
Trade, Transportation and Utilities	23.9%
Information	3.4%
Financial Activities	4.2%
Professional and Business Services	6.6%
Education and Health Services	30.3%
Leisure and Hospitality	9.9%
Other Services	3.4%
Public Administration	2.9%

4.6 INDUSTRY

Blue Earth County's major employers and their general information are listed in Figure 4-6.

Figure 4-6: Major Employers[13]

Mayo Clinic Health System Description: Hospitals Naics:622110 1025 Marsh St # 4 Mankato, MN 56001 No. Of Employees:1,000-4,999 Phone:5076254031 Website: mayoclinichealthsystem.org Established:1984	**Minnesota State University - Mankato** Description: Schools-Universities & Colleges Academic Naics:611310 620 South Rd Mankato, MN 56001 No. Of Employees:1,000-4,999 Phone:5073891866 Fax:5073892960 Website:MNSU.EDU Established:1866
Mankato Area Public Schools ISD 77 Description: Schools Naics: 611110 10 Civic Center Plz # 1 Mankato, MN 56001 No. Of Employees:1,000-4,999 Phone: 5073871868 Fax: 5073874257 Website: isd77.org Established:1984	**MRCI Work Source** Description: Rehabilitation Facility Naics: 541612 1611 Monks Ave Mankato, MN 56001 No. Of Employees:250-499 Phone: 5073865799 Fax: 5073865696 Website: MRCIWORKSOURCE.ORG Established: 1996
Hickory Tech Corp Description: Telephone Companies Naics:517110 221 E Hickory St Mankato, MN 56001 No. Of Employees:250-499 Phone:5073871151 Fax:5076259191 Website: HICKORYTECH.COM Established: 1898	**Mankato Clinic** Description: Clinics Naics:621493 1230 E Main St Mankato, MN 56001 No. Of Employees:250-499 Phone:5076251811 Website: MANKATOCLINIC.COM Established:1984
Menards Description: Home Centers Naics: 444110 1771 Premier Dr Mankato, MN 56001 No. Of Employees:250-499 Phone: 5073873400 Fax: 5073873533 Website: MENARDS.COM Established: 1984	**Verizon Wireless Center** Description: Recreation Centers Naics:713940 1 Civic Center Plz Mankato, MN 56001 No. Of Employees:250-499 Phone:5073893000 Fax:5073451627 Website:VERIZONWIRELESSCENTERMN.COM Established:2011
Walmart Supercenter Description: Department Stores Naics: 452111 1881 Madison Ave Mankato, MN 56001 No. Of Employees:250-499 Phone: 5076259318 Fax: 5076257255 Website: WALMART.COM Established: 1984	**Red Brick Learning** Description: Books-Publishing & Printing (Mfrs) Naics: 511130 151 Good Counsel Dr Mankato, MN 56001 No. Of Employees:250-499 Phone: 5073883018 Established: 2009

4.7 LAND USE AND DEVELOPMENT TRENDS

The land area of the County is approximately 752 square miles or roughly 481,000 acres. As seen in the following Existing Land Use Map, the City of Mankato has the highest intensity of development. Mankato is a growing community. Due to the natural physical boundaries (the Minnesota and Blue Earth River) this growth is planned to continue to occur to the south and east of the community.

Most of the natural vegetation is along the water bodies within the County. Residential development has occurred along river ways and along the lakes in the northeastern portion of the county.

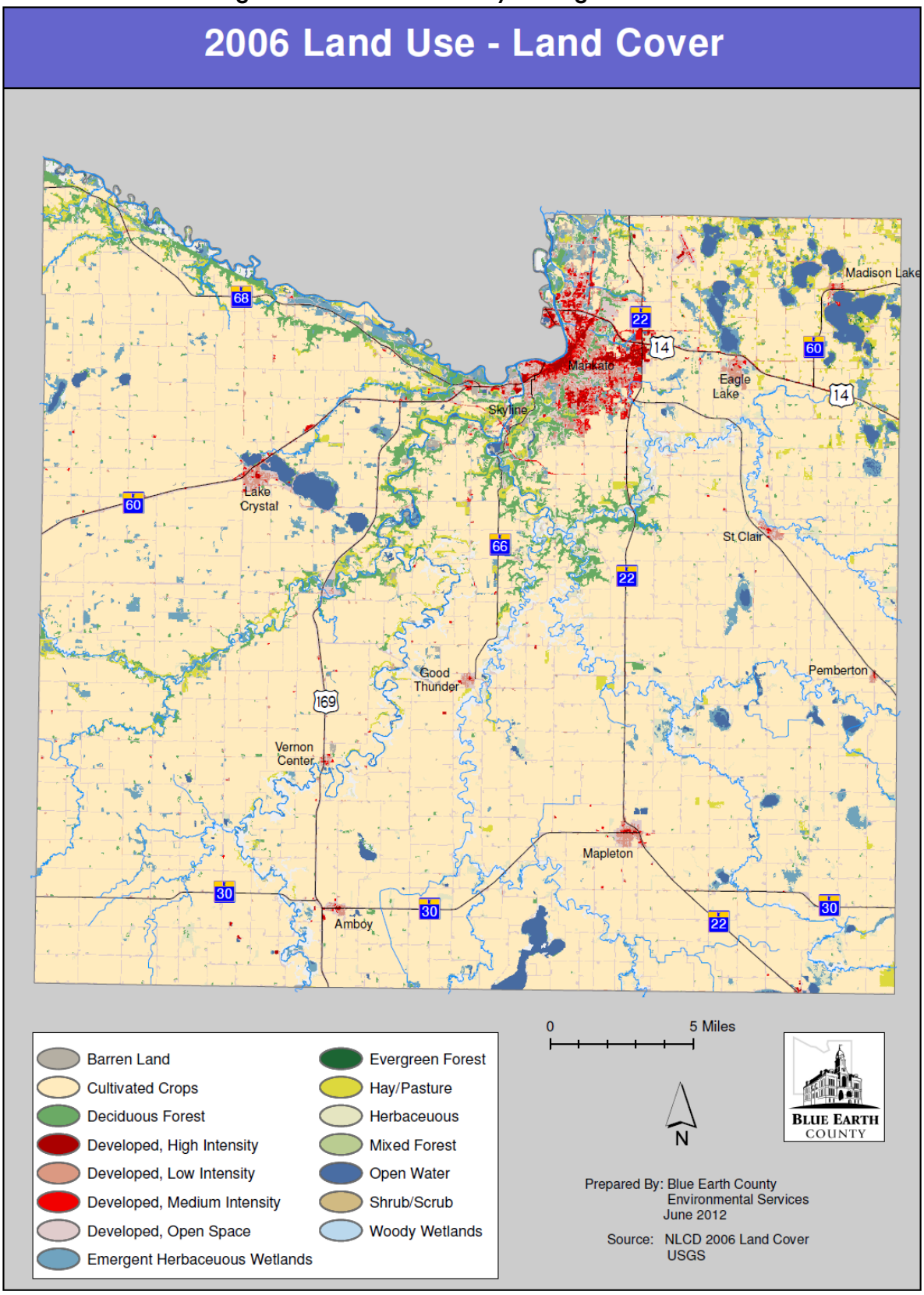
A majority of land is utilized for cultivating crops. Below is a summary of the characteristics of agriculture land used for cultivating crops or housing livestock.

Figure 4-7: County Agricultural Profile[14]

General Characteristics	2002	2007	% Change
Number of farms	1125	1247	11%
Land in Farms	405,564 acres	415,326 acres	2%
Average Size of Farm	361 acres	333 acres	-8%
Top Crop Items			
Crops	**Acres**	**State Rank**	**U.S. Rank**
Corn for Grain	201,872	6	52
Soybeans for beans	146,852	12	39
Forage - Land used for all hay and haylage, grass silage, and greenchop	3,995	76	2,460
Vegetables harvested for sale	2,223	30	329
Corn for Silage	1,408	61	821
Top Livestock Inventory Items (number)			
Livestock	**Quantity**	**State Rank**	**U.S. Rank**
Hogs and pigs	537,657	2	15
Turkeys	141,186	26	143
Cattle and calves	13,739	58	1,748

Another key characteristic from the Existing Land Use Map is the many water bodies within the County. The rivers impact land use by cutting steep bluff lines throughout the County. Erosion of land is a concern and is discussed further in other sections of the Hazard Mitigation Plan. Additional characteristics of the County's water bodies can be found in Section 4.8 Major Lakes, Rivers, and Watersheds.

Figure 4-8: Blue Earth County Existing Land Use[15]



4.8 MAJOR LAKES, RIVERS, AND WATERSHEDS

The County's principal waters are public and are a major government responsibility. These waters are greatly affected by private land use activities. As a result of this private land use pattern, residential and agricultural pollution from these uses enter public waters. The Land Use Plan combined with County regulatory ordinances strive to eliminate or at least minimize negative impacts from pollution causing land uses.

Most of the County lies within the Greater Blue Earth River Watershed the headwaters of which are in northern Iowa. The Blue Earth River and its tributaries flow in a northerly direction, forming a dendretic drainage pattern converging near the south bend of the Minnesota River contributing an appreciable amount to its volume. The rivers and streams included in the drainage system are listed below:

1. Blue Earth River
2. Le Sueur River
3. Maple River
4. Cobb River
5. Little Cobb River
6. Watonwan River
7. Rice Creek
8. Willow Creek
9. Perch Creek
10. Minneopa Creek
11. Morgan Creek
12. Little Cottonwood River

These waterways are significant topographic features of the County in that they form valleys with precipitous tree covered slopes thus providing scenic beauty valued by many. The relief of several valleys is more than 100 feet and along the Minnesota River west of the City of Mankato the bluffs average 200 feet above the riverbed.

High stream flows usually occur in the spring, which generally retreat within short periods of time. The extreme depth of the valleys prevents massive damage during flash floods caused by rapid runoff. Rapid runoff does contribute a great deal to the flood flows of the Minnesota River, however. Low flows occur during late summer, autumn and midwinter as the streams in the headwaters of the Minnesota River generally have very low or no flow at all. In the lower part of the watershed there is a continuous stream flow due to the groundwater recharge from springs which issue from the bluffs along the stream valleys.

The upland plain is utilized for extensive agricultural activities. There are areas in the upland plain that are poorly drained and dotted and with swamplands and lakes. Blue Earth County has within its borders approximately 19,000 acres of lake waters of varying depth, area and quality. The locations of these water bodies are generally concentrated in the eastern and northwestern quadrants of the County. The several lakes in the northeast section of the County are part of the extensive Prairie Lake Region of Southern Minnesota. Ballantyne, Duck, Madison, and Eagle Lakes are important water areas of northeastern Blue Earth

County, while Lily, Crystal, and Loon Lakes are important water areas that are located in the northwest. Rapidan Lake, located in the northcentral part of the County, is a man-made reservoir that was formed by the Rapidan Dam on the Blue Earth River. Lura and Minnesota Lakes are large bodies of water extending southward out of the County into Faribault County.[16]

The county crosses four watersheds: Le Sueur, Blue Earth, Watonwan, and Middle Minnesota. A list of the Hydrologic Unit Code (HUC) watersheds is included in Figure 4-9.

Figure 4-9: Watersheds[17]

Watershed Name	HUC Code
Le Sueur	07020011
Blue Earth	07020009
Watonwan	07020010
Middle Minnesota	07020007
Canon	07040002

4.9 CITY PROFILES

CITY OF AMBOY

General Location	Amboy is located in the southwest portion of Blue Earth County near the intersection of State Highway 30 (east-west) and US Highway 169 (north-south).	
Demographic Characteristics (2011)	2011 Population	575
	2016 Population (Forecast)	659
	Households	235
	Labor Force	293
	Education (Completed High School)	95%
	Education (Completed Bachelor's Degree)	16%
Utility Providers	Electricity	Alliant Energy
	Natural Gas:	Center Point Energy
	Wastewater:	Municipal
	Water:	Municipal
Total Dwelling Units (2011)	There are 264 dwelling units in the city, 235 of which are occupied.	

CITY OF EAGLE LAKE

General Location	Eagle Lake is located in the northeast portion of Blue Earth County off US Highway 14 (east-west) and MN State Highway 60 (southwest-northeast).	
Demographic Characteristics (2011)	2011 Population	2,476
	2016 Population (Forecast)	2,704
	Households	905
	Labor Force	1,519
	Education (Completed High School)	95%
	Education (Completed Bachelor's Degree)	27%
Utility Providers	Electricity	BENCO, Xcel Energy
	Natural Gas:	Center Point Energy, Greater Minnesota Gas
	Wastewater:	Municipal
	Water:	Municipal
Total Dwelling Units (2011)	There are 964 dwelling units in the city, 905 of which are occupied.	

CITY OF GOOD THUNDER

General Location	Good Thunder is located in the central portion of Blue Earth County at the end of State Highway 66 (north-south).	
Demographic Characteristics (2011)	2011 Population	589
	2016 Population (Forecast)	625
	Households	227
	Labor Force	339
	Education (Completed High School)	95%
	Education (Completed Bachelor's Degree)	17%
Utility Providers	Electricity	Xcel Energy
	Natural Gas:	Center Point Energy
	Wastewater:	Municipal
	Water:	Municipal
Total Dwelling Units (2011)	There are 241 dwelling units in the city, 227 of which are occupied.	

CITY OF LAKE CRYSTAL

General Location	Lake Crystal is located in the northwest portion of Blue Earth County off State Highway 60. (southwest-northeast).	
Demographic Characteristics (2011)	2011 Population	2,703
	2016 Population (Forecast)	3,241
	Households	1,113
	Labor Force	1,442
	Education (Completed High School)	93%
	Education (Completed Bachelor's Degree)	28%
Utility Providers	Electricity	Municipal
	Natural Gas:	Center Point Energy
	Wastewater:	Municipal
	Water:	Municipal
Total Dwelling Units (2011)	There are 1,200 dwelling units in the city, 1,113 of which are occupied.	

CITY OF MADISON LAKE

General Location	Madison Lake is located in the northeast portion of Blue Earth County off State Highway 60 (southwest-northeast).	
Demographic Characteristics (2011)	2011 Population	1,047
	2016 Population (Forecast)	1,170
	Households	403
	Labor Force	625
	Education (Completed High School)	94%
	Education (Completed Bachelor's Degree)	22%
Utility Providers	Electricity	Xcel Energy
	Natural Gas:	Xcel Energy
	Wastewater:	City of Mankato
	Water:	Municipal
Total Dwelling Units (2011)	There are 507 dwelling units in the city, 403 of which are occupied.	

CITY OF MANKATO

General Location	Mankato is located in the northeast portion of Blue Earth County where State Highway 60 State (southwest-northeast), State Highway 22 (north-south), US Highway 14 (east-west), and US Highway 169 (north-south) converge.	
Demographic Characteristics (2011)	2011 Population	40,307
	2016 Population (Forecast)	44,502
	Households	15,004
	Labor Force	24,979
	Education (Completed High School)	92%
	Education (Completed Bachelor's Degree)	33%
Utility Providers	Electricity	BENCO, Xcel Energy
	Natural Gas:	Center Point Energy, Greater Minnesota Gas
	Wastewater:	Municipal
	Water:	Municipal
Total Dwelling Units (2011)	There are 15,931 dwelling units in the city, 15,004 of which are occupied.	

CITY OF MAPLETON

General Location	Mapleton is located in the southeast portion of Blue Earth County near the intersection of State Highway 22 (north-south) and State Highway 30 (east-west).	
Demographic Characteristics (2011)	2011 Population	1,791
	2016 Population (Forecast)	1,952
	Households	695
	Labor Force	979
	Education (Completed High School)	92%
	Education (Completed Bachelor's Degree)	20%
Utility Providers	Electricity	BENCO, Xcel Energy
	Natural Gas:	Northwest Gas
	Wastewater:	Municipal
	Water:	Municipal
Total Dwelling Units (2011)	There are 739 dwelling units in the city, 695 of which are occupied.	

CITY OF PEMBERTON

General Location	Pemberton is located in the southeast portion of Blue Earth County off State Highway 83 (north-south).	
Demographic Characteristics (2011)	2011 Population	259
	2016 Population (Forecast)	301
	Households	97
	Labor Force	145
	Education (Completed High School)	95%
	Education (Completed Bachelor's Degree)	22%
Utility Providers	Electricity	Xcel Energy
	Natural Gas:	Northern Natural Gas
	Wastewater:	Private
	Water:	Municipal
Total Dwelling Units (2011)	There are 104 dwelling units in the city, 97 of which are occupied.	

CITY OF SKYLINE

General Location	Skyline is located in the northeast portion of Blue Earth County off State Highway 66 (north-south).	
Demographic Characteristics (2011)	2011 Population	290
	2016 Population (Forecast)	304
	Households	109
	Labor Force	162
	Education (Completed High School)	99%
	Education (Completed Bachelor's Degree)	32%
Utility Providers	Electricity	BENCO, Xcel Energy
	Natural Gas:	Center Point Energy
	Wastewater:	City of Mankato
	Water:	Municipal
Total Dwelling Units (2011)	There are 115 dwelling units in the city, 109 of which are occupied.	

CITY OF ST. CLAIR

General Location	St. Clair is located in the northeast portion of Blue Earth County off State Highway 83 (north-south).	
Demographic Characteristics (2011)	2011 Population	872
	2016 Population (Forecast)	914
	Households	308
	Labor Force	484
	Education (Completed High School)	97%
	Education (Completed Bachelor's Degree)	34%
Utility Providers	Electricity	Xcel Energy
	Natural Gas:	Xcel Energy
	Wastewater:	Municipal
	Water:	Municipal
Total Dwelling Units (2011)	There are 317 dwelling units in the city, 308 of which are occupied.	

CITY OF VERNON CENTER

General Location	Vernon Center is located in the southwest portion of Blue Earth County off US Highway 169 (north-south).	
Demographic Characteristics (2011)	2011 Population	367
	2016 Population (Forecast)	481
	Households	145
	Labor Force	188
	Education (Completed High School)	92%
	Education (Completed Bachelor's Degree)	19%
Utility Providers	Electricity	Interstate Power
	Natural Gas:	Energy Point Gas
	Wastewater:	Municipal
	Water:	Municipal
Total Dwelling Units (2011)	There are 160 dwelling units in the city, 145 of which are occupied.	

5.0 RISK ASSESSMENT

5.1. HAZARD IDENTIFICATION

Hazard identification is a critical component of the mitigation planning process. The Steering Committee for this hazard mitigation planning process took a comprehensive approach to hazard identification.

The reorganization of the hazards for the update took into consideration several documents, including FEMA's Multi-Hazard Identification and Risk Assessment, 2008 Minnesota All-Hazard Mitigation Plan, 2011 Minnesota All-Hazard Mitigation Plan Update, and HSEM's River County Template. A number of other county hazard mitigation plans were reviewed as well. The reorganization was undertaken to simplify the categorization of hazards.

5.1.1 EXISTING BLUE EARTH COUNTY PLAN

The 2008 county plan identified 13 hazards. In the 2013 update of the plan, the original hazards were reconsidered and reorganized. The changes are depicted left-to-right in Figure 5-1 below.

Figure 5-1: Hazards 2008 Plan vs. 2013 Update

Hazards in 2008 Plan	Hazards in 2013 Update
Winter Storms	Severe Winter Weather
Summer Storms	Earthquake
Flooding	Drought
Wildfire	Fire
Extreme Temperatures	Infectious Disease
Drought	Hazardous Material Release
Infectious Disease	Invasive Species
Fire (Structural)	Infrastructure Failure
Hazardous Materials	Tornado
Wastewater Treatment Failure / Water Supply Contamination	Water Supply Contamination
Dam Failure	Flood
Terrorism	Near-channel erosion - Riverine and Ravine Erosion and Landslides
	Terrorism
	Severe Summer Weather
	Animal and Crop Disease
	Sinkholes and Land Subsidence

Changes from the 2008 plan include:

- Winter Storms expanded to include Severe Winter Weather
- Tornados removed from Summer Storms and given its own category
- Wildfire combined with Structure Fire into a Fire category
- Hazardous Material changed to Hazardous Material Release
- Wastewater Treatment Failure/Water Supply Contamination changed to Water Supply Contamination
- Extreme Temperatures placed into Severe Summer Weather
- Addition of Earthquake
- Addition of Near-channel erosion - Riverine and Ravine Erosion and Landslides

- ❖ Addition of Animal and Crop Disease
- ❖ Addition of Sinkholes and Land Subsidence
- ❖ Addition of Invasive Species

5.1.2 STATE PLAN

The Minnesota All-Hazard Mitigation Plan (2008 and 2011) was consulted for hazard identification. Definitions and terminology were utilized from the State's plan to provide consistency and clarification in the planning process.

5.1.3 CITY/TOWNSHIP SURVEY

The Steering Committee for this hazard mitigation planning process drafted a survey that was presented to the governing boards of cities and townships within Blue Earth County. Cities and townships had the opportunity to add additional hazards for evaluation when completing the survey. Cities and townships suggested 4 additional hazards. After review, these suggestions were already covered under other hazards previously identified.

Figure 5-2: Suggested Additional Hazards for Evaluation

Jurisdiction	Suggested Hazard	Suggestion Hazard is Covered By
City of Skyline	Power outage	Infrastructure Failure
City of Vernon Center	Grain elevator explosion	Infrastructure Failure
City of St. Clair	Pandemic flu or other outbreak	Infectious Disease
Cambria Township	Hazardous materials from train derailment	Hazardous Material Release

The results of the city/township survey are discussed in the Vulnerability Assessment in Section 5.2.

5.1.4 SPECIAL CONSIDERATIONS

Blue Earth County conducted an additional risk assessment into river and streambank erosion. Results of this hazard's risk assessment are found in the "Near-channel erosion - Riverine and Ravine Erosion and Landslides" hazard profile. This hazard warrants special consideration because of the significant impact it has on the county and the lack of information available on the probability of occurrence.

5.1.5 NATIONAL CLIMATIC DATA CENTER RECORDS[18]

The National Climatic Data Center provided the storm event data used in this update. It should be noted that NCDC records are estimates of damage complied by the National Weather Service from local, state, and national sources. These estimates are often preliminary in nature. The estimates may not match the final assessment of the damage related to a specific weather event.

The NCDC lists 395 reported weather events having occurred in Blue Earth County between 4/30/1950 and 08/31/2011. The profile section of the update includes summaries of the following hazards from the NCDC listing: blizzards, extreme cold/wind chill, excessive heat, flash flood/flood, funnel cloud, hail, excessive heat, heavy rain, heavy snow, high wind, ice storm, lightning, thunderstorm, tornado, and winter storm.

5.2 VULNERABILITY ASSESSMENT

5.2.1 CRITICAL FACILITIES

5.2.1.A. ESSENTIAL FACILITIES

Essential facilities are vital to the health and welfare of the whole population and are especially important following hazard events. Essential facilities include: medical facilities (hospitals and clinics), police and fire stations, emergency operations centers, and schools.

As part of the update process, a total of 63 essential facilities were identified in Blue Earth County, including: 8 police stations, 14 fire stations, 14 medical facilities, and 27 schools. Figures 5-3 through 5-6 list these individual essential facilities, their location, and estimated replacement values, as determined by the Blue Earth County Assessor's Office[19] using the most recent data available.

Figure 5-3: Essential Facilities – Law Enforcement[20]

Facility	Location	Replacement Value
Amboy Police Department	244 East Maine Street, Amboy	$193,100
Mankato Police Department (Public Safety Center)	710 South Front Street, Mankato	$4,903,800
Mapleton Police Department	102 2nd Avenue Northeast, Mapleton	$127,100
Good Thunder Police Department	130 North Ewing Street, Good Thunder	$230,600
Lake Crystal Police Department	101 North Main Street, Lake Crystal	$47,400
Eagle Lake Police Department	705 Parkway Avenue, Eagle Lake	$892,200
Madison Lake Police Department	525 Main St, Madison Lake	$207,300
Blue Earth County Sheriff's Office & Jail	401 Carver Rd, Mankato	$82,543,600

Figure 5-4: Essential Facilities – Emergency Response[21]

Facility	Location	Replacement Value
Amboy Fire Department	100 E Maine St, Amboy	$31,100
Mankato Fire Department (Public Safety Center)	710 South Front Street, Mankato	$4,903,800
Mankato Fire Station #2	901 N Broad St, Mankato	$1,776,900
Mankato Fire Station #3	1230 Pohl Road, Mankato	$3,708,300
Mapleton Fire Department	103 3rd Ave Se, Mapleton	$73,300
Lake Crystal Fire Department	181 S Hunt Street, Lake Crystal	$427,700
Eagle Lake Fire Department	101 Plainview Avenue, Eagle Lake	$130,700
Vernon Center Fire Department	101 Oak St, Vernon Center	$12,400
Pemberton Fire Department	141 4th St, Pemberton	$420,800
St. Clair Fire Department	304 Main St W, St. Clair	$140,100
Madison Lake Fire Department	525 Main St, Madison Lake	$207,300
Good Thunder Fire Department	430 Main St, Good Thunder	$400,800
Skyline Volunteer Fire Department	S Skyline Dr, Skyline	$162,000
South Bend Township Fire Department	306 S McKenzie St, Mankato	$136,000

Figure 5-5: Essential Facilities – Medical Care[22]

Facility	Location	Replacement Value
Mayo Clinic Health System – Mankato	1025 Marsh Street, Mankato	$72,850,700
Mayo Clinic Health System (Madison East)	1400 Madison Ave Suite 324, Mankato	NA
Mankato Clinic	1230 E Main Street, Mankato	$11,446,700
Mankato Surgery Center	1411 Premier Drive, Mankato	$2,742,000
Mankato Clinic Mapleton Family Practice	305 Main Street NE, Mapleton	$188,100
Mayo Clinic Eastridge	101 Martin Luther King Junior Drive, Mankato	$6,537,200
OFC Back Care Center	1431 Premier Drive, Mankato	$5,803,600
Open Door Health Center	309 Holly Lane #101, Mankato	$1,643,400
Parkview Medical Clinic	102 S Main St, Lake Crystal	$151,100
Mankato Clinic – Lake Crystal	221 S Murphy St, Lake Crystal	$203,400
Wickersham Health Campus	1421 Premier Drive, Mankato	$7,140,500
Mankato Clinic – Urgent Care Clinic	1809 Adams St, Mankato	NA
Mankato Clinic Express	1850 Adams St, Mankato	NA

Figure 5-6: Essential Facilities – Schools[23]

Facility	Location	Replacement Value
All Saints Catholic School	600 3rd St, Madison Lake	$816,300
Bridges Community Elementary	820 Hubbell Avenue, Mankato	$2,478,800
Central Freedom School; Central Middle School Alp; Central High Area Learning Center; and Life Lines Adult Connection	110 Fulton Street, Mankato	$8,056,300
Eagle Lake Elementary	500 Le Sueur Avenue, Eagle Lake	$4,904,400
Fitzgerald Middle School	110 North 5th St, Mankato	$5,433,200
Franklin Elementary	1000 N Broad Street, Mankato	$9,518,700
Grace Christian School	600 Lind St, Mankato	$869,300
Immanuel Lutheran School	421 N 2nd St, Mankato	$4,411,800
Jefferson Elementary	100 James Avenue, Mankato	$2,427,600
Kennedy Elementary	2600 E Main Street, Mankato	$3,775,200
Lake Crystal Welcome Memorial El.	502 E Watonwan Street, Lake Crystal	$4,061,400
Lake Crystal Welcome Memorial Sec.	607 Knights Lane, Lake Crystal	$385,100
Loyola Catholic School	145 Good Counsel Drive, Mankato	$16,382,100
Mankato East High (Jr. and Snr.)	2600 Hoffman Road, Mankato	$17,725,200
Mankato West Senior High	1351 S Riverfront Drive, Mankato	$13,167,400
Mankato Headstart Center	105 North 5th Street, Mankato	
Maple River Central Elementary; and Maple River Senior High	101 6th Avenue NE, Mapleton	$4,035,300
Maple River East Elementary	126 Higbie Avenue East, Minnesota Lake	$1,036,800[24]
Maple River West Elementary	311 Willard Street, Good Thunder	$1,791,700
Maple River West Middle	211 W Main Street, Amboy	$1,169,100
Mount Olive Lutheran School	1123 Marsh St, Mankato	$4,369,700

Facility	Location	Replacement Value
Risen Savior Lutheran School	502 W 7th St, Mankato	$201.700
Riverbend Academy	110 N 6th Street, Mankato	$8,569,000
Roosevelt Elementary	300 W 6th Street Mankato	$1,501,100
Rosa Parks Elementary	1001 Heron Drive, Mankato	$19,974,300
St. Clair Elementary; and St. Clair Secondary	121 W Main Street, St. Clair	$9,802,500
St. John's Lutheran	Sherman and Hubbell, Good Thunder	$124,400
Washington Elementary	1100 Anderson Drive, Mankato	$3,656,900

5.2.1.B. TRANSPORTATION SYSTEMS

Transportation systems are essential to the social and economic needs of our society. These systems also play a critical role in the response to and recovery from hazard events. Essential transportation systems include: airway, highway, railway, and waterway facilities and infrastructure. Figure 5-7 summarizes the transportation systems identified through the update process.

Figure 5-7: Transportation Systems

Type	Description	Replacement Value
Airway[25]	1 Airport (owned by city of Mankato); Located at 3030 Airport Road, Mankato)	$19,388,800
Highway[26]	732 Miles of County Road; 620 Miles of Township Roads; and 165 Miles of Trunk Highway,	NA
Railway[27]	14 Miles of Canadian Pacific; 25 miles of Union Pacific	NA

There are a total of 189 bridges in Blue Earth County. According to the Federal Highway Administration, 10 of these bridges are structurally deficient.[28] The classification "Structurally Deficient" is used to determine eligibility for federal bridge replacement and rehabilitation funding.[29] Bridges that are deemed to be structurally deficient are not necessarily unsafe. A structurally deficient bridge typically needs maintenance, repair, and eventual rehabilitation or replacement to address deficiencies. To remain open to traffic, structurally deficient bridges are often posted with reduced weight limits that restrict the gross weight of vehicles using the bridges. If unsafe conditions are identified during a physical inspection, the structure will be closed.

5.2.1.C. LIFELINE UTILITY SYSTEMS

Lifeline utility systems are essential for the provision of basic services, such as heat, power, and potable water. These systems include the facilities and infrastructure related to: electric power, potable water, wastewater/stormwater, natural gas, and oil. Figures 5-8 through 5-12 list the number and type of lifeline utility systems identified through the update process.

The following is a list of electric service providers within Blue Earth County:

- Brown County Rural Elec. Assn.

- Lake Crystal
- Minnesota Valley Elec. Coop.
- Interstate Power Co.
- Frost-Benco Wells Coop. Elec. Assn.
- South Central Elec. Assn.
- Steele-Waseca Coop. Elec. Co.
- Federated Rural Elec. Assn.
- XCEL

Figure 5-8: Lifeline Utility Systems – Major Electric Power Facilities[30]

Owner	Description	Location	Replacement Value
BENCO Electric Cooperative	Head Quarters Office for a Distribution Center	20946 549th Avenue, Mankato	$1,355,100
Xcel Energy, Mankato	Wilmath Plant[31]	1040 Summit Avenue, Mankato	$26,865,400
Xcel Energy, Mankato	Key City Plant[32]	800 Summit Avenue, Mankato	$4,477,900
Lake Crystal Municipal Utilities	Electric Generating Power Plant	111 W Humphrey St, Lake Crystal	$95,100
Rapidan Dam	Electric Generating Dam	Glory Lane, Mankato	NA

Figure 5-9: Lifeline Utility Systems – Potable Water[33]

Owner	Description	Location	Replacement Value
City of Amboy	Water Tower	244 East Main	$452,550
	Well	244 East Main	$30,750
	Well	244 East Main	$30,750
City of Eagle Lake	Water Tower	97 3rd St North	$513,300
	Well	97 3rd St North	
	Well	100 Thomas Drive	$127,100
	Well	100 Thomas Drive	
City of Good Thunder	Water Tower	131 Ewing Street	$113,700
Lake Crystal Municipal Utilities	Water Tower - elevated - 250,000 gallons	137 South Lincoln Street	$473,800
	Water Tower - ground storage - 500,000 gallons	137 South Lincoln Street	$676,856
	Well #2	137 South Lincoln Street	$17,132
	Well #3	137 South Lincoln Street	$31,527
	Well #4	132 South Lilly Street	$68,071
	Well #5	411 West Blue Earth Street	$68,439
City of Madison Lake	Water Tower	61550 230th St.	$146,500
	Well #2	608 Main St	$232,200
	Well #3	61550 230th St.	$146,500
City of Mankato	Water Treatment Plant	740 Mound Ave	$44,350,000
	High Lift Pump Station	744 Mound Ave	$3,420,000
	Madison Ave Reservoir	2055 Madison Ave	$3,300,000
	Balcerzak Dr Reservoir	266 Balcerzak Dr	$4,989,000
	Hilltop Reservoir 1/2	740 E Mulberry St	$999,000
	North Reservoir	50 Good Counsel Dr	$2,846,000
	Dolph Reservoir	800 Val Imm Dr	$6,066,000

Owner	Description	Location	Replacement Value
	Well #11	NA	$1,040,000
	Well #12	NA	$730,000
	Well #13	NA	$770,000
	Well #14	NA	$1,100,000
	Well #15	NA	$670,000
	Well #16	NA	$660,000
Mapleton Municipal Utilities	Water Tower	300 Central Avenue South	$304,400
	Filter Plant	208 Silver Street E	$31,900
	Well #2	208 Silver Street E	
	Well #3	104 1st Avenue NE	NA
City of Pemberton	Water Tower	141 4th St	$420,800
	Well	141 4th St	
City of St. Clair	Water Tower	200 Park Street	$617,100
	Well #1	200 Park Street	
	Well #2	200 Park Street	
	Water Treatment Plan	200 Park Street	
City of Skyline	Water Tower	94° 1' 54" West and 44° 8' 26" North	$289,700
City of Vernon Center	Water Tower		$487,500
	Well #1	200 Main Street West	$187,500
	Well #1	200 Main Street West	$187,500

Figure 5-10: Lifeline Utility Systems – Wastewater/Stormwater[34]

Owner	Description	Location	Replacement Value
City of Amboy	Wastewater Treatment Plant	600 West Main	$1,988,806
City of Eagle Lake	None	NA	NA
City of Good Thunder	Lagoons	55408 Husky Rd	$89,000
Lake Crystal Municipal Utilities	Water Treatment Plant - Main Facility	137 South Lincoln Street	$3,330,279
	Water Treatment Plant - Booster Facility	109 South Lincoln Street	$447,053
	Wastewater Treatment Plant (Upper - Main Facility)	532 East Hudson Street	$3,988,151
	Wastewater Treatment Plant (Lower)	542 North Main Street	$3,988,151
	Humphrey Street Sanitary Sewer Lift Station #1	420 East Humphrey Street	$335,027
	Humphrey Street Sanitary Sewer Lift Station #2	891 East Humphrey Street	$137,146
	Industrial Park Sanitary Sewer Lift Station	458 Scott Street	$138,079
	Jones Park Sanitary Sewer Lift Station	700 South Main Street	$272,057
	Crystal Creek Sanitary Sewer Lift Station	1124 Crystal Lake Drive	$270,740
City of Madison Lake	North Shore Lift Station	717 Point Ave	$247,400
	Ballpark Lift Station	301 7th St	$46,900
	South Duck Lift Station	120 Cedar Ln	NA
	North Duck Lift Station	100 N Duck Lake Ave	NA
	Point Pleasant Lift Station	400 Sheppard Cr	$990,600
City of Mankato	Wastewater Treatment Plant	730 Mound Ave	$75,810,000

Owner	Description	Location	Replacement Value
	West Mankato (Woodland)	1731 Woodland Ave	$226,100
	Airport Lift Station	2901 Airport Ln	$657,000
	Harper Lift Station	1962 7th Ave	$204,000
	Hwy 169 Lift Station	1951 HWY 169 N	$795,000
	Lundin Lift Station	330 Lundin Blvd	$547,000
	Madison Lake Lift Station	648 Spruce Ave	$1,040,000
	Mohr Dr Lift Station	181 Mohr Dr	$324,000
	Monks Ave Lift Station	2840 Monks Ave	$501,000
	Mulberry Lift Station	104 E Mulberry St	$2,941,000
	Northside Lift Station	105 Pauley Way	$579,000
	Pohl Creek Lift Station	231 Tanager Rd	$590,000
	Stoltzman Lift Station	5 Stony Creek Rd	$241,000
	Telemark Lift Station	91 Telemark Dr	$117,000
	3rd Ave Lift Station	2950 3rd Ave	$406,000
	River Dr Lift Station	1244 W River Dr	$451,000
	Honeymead Flood Station	905 Mound Ave	$997,000
	Indian Creek Flood Station	202 Sibley Parkway	$3,128,000
	Warren Creek Flood Station	128 A St	$1,794,000
	Mulberry Flood Station	298 N Riverfront Dr	$1,474,000
	Lake Street Flood Station	111 Pauley Way	$2,483,000
Mapleton Municipal Utilities	Lift Station	500 Silver St W	NA
	Sewage Pump	875 Highway 22 South	NA
City of Pemberton	None	NA	NA
City of St. Clair	Wastewater Treatment Plan	336 Main Street West	$188,400
	Lift Station	336 Main Street West	
City of Skyline	None	NA	NA
City of Vernon Center	Wastewater Treatment Plant	312 Hilltop Street	$3,390,000

Figure 5-11: Lifeline Utility Systems – Solid Waste Disposal[35]

Owner	Description	Location	Replacement Value
Waste Management	Blue Earth County Recycling Center	725 Waseca Avenue, LeHillier Area -Mankato	$310,400
Southern Minnesota Construction	Compost Site	57032 231 Lane, Mankato	$423,800
Southern Minnesota Construction	The Pilgrim Demolition Landfill	3600 3rd Avenue, Mankato	$266,200
Blue Earth County	Household Hazardous Waste Facility / Product Reuse Center	651 Summit Avenue, Mankato	$346,700
Blue Earth County	Ponderosa Landfill	20028 Gooseberry Lane, (Formerly Co. Rd. 34), Mankato	$210,000
Minnesota Waste Processing Company	Privately owned transfer station	1051 Summit Ave, Mankato	$76,300

Figure 5-12 lists the pipelines found within Blue Earth County. Further information on pipelines, including their location can be found through the Minnesota Department of Transportation.[36]

Figure 5-12: Lifeline Utility Systems – Pipelines[37]

Owner	Description
Alliance Pipeline Ltd	Gas Pipeline
Centerpoint Energy Resources Corp.	Gas Pipeline
CPN Pipeline Company	Gas Pipeline
Enterprise Products Operating LLC	Gas Pipeline
Kinder Morgan Cochin LLC	Gas and Crude Oil Pipelines
Magellan Ammonia Pipeline, LP	Ammonia Gas Pipeline
Magellan Pipeline Company, LP	Crude Oil Pipeline
Northern Natural Gas Co.	Gas Pipeline

5.2.1.D. HIGH POTENTIAL LOSS FACILITIES

High potential loss facilities are those facilities that would have a potentially high loss associated with them in the event of a hazard event. Examples of these systems include: dams, military installations, and nuclear power plants.

Figure 5-13 summarizes the dams located in the county. Replacement values for dams were not available.

Figure 5-13: Dams[38]

Dam Name	Owner	Type	Location	Max Storage (Acre Feet)
Eagle Lake	SWCD of Blue Earth	Gravity	S07 T108N R25W	0
Cottonwood Lake Dam	MN DNR	Gravity-Earth	S32 T106N R25W	1172
Perch Lake Dam	MN DNR - Fisheries	Earth	S13 T106N R26W	2844
Rapidan	Blue Earth County	Other	S08 T107N R27W	8549
Blue Earth River	MN DNR	Concrete-Gravity	S14 T108N R27W	0
Warren St. Detention	City of Mankato	Earth	S19 T108N R26W	45
Gilfillin Lake Outlet	MN DNR	Earth	S33 T109N R25W	1200
Madison Lake	MN DNR	-	S10 T108N R25W	0
Rice Lake	MN DNR - Fisheries	Earth	S30 T107N R25W	1500
McPherson 25	Rye, Gordon	Earth	S25 T107N R25W	70
Lost Marsh WMA	MN DNR - Fisheries	Earth	S35 T106N R25W	950
Lake Crystal	Blue Earth County	Sheet Pile Weir	S32 T108N R28W	0

Figure 5-14 lists the other high potential loss facilities identified through the update process, including individual facility type, location, and replacement value.

Figure 5-14: High Potential Loss Facilities

Facilities Name	Facility Type	Location	Replacement Value
Minnesota State University, Mankato	State University	117 Centennial Student Union, Mankato	$133,965,400.00
Koch Industries	Chemical Industry	16078 US Highway 169, Garden City	$1,001,200
Rasmussen College	College	130 St Andrews Drive, Mankato	$3,337,300
Bethany Lutheran College Campus	College	700 Luther Drive, Mankato	$55,123,500[39]
Blue Earth County Government Center	Government	410 S. 5th St, Mankato	$1,930,400
Verizon Wireless Civic Center	Civic Center	1 Civic Center Plaza, Mankato	$37,485,200
River Hills Mall	Shopping Center	1850 Adams St, Mankato	$54,370,300[40]
Minnesota Department of Transportation – District 7 Headquarters	Government	2151 Basset Drive, Mankato	$13,935,200
Intergovernmental Center	Government	10 Civic Center Plaza, Mankato	NA

5.2.1.E. HAZARDOUS MATERIAL FACILITIES

Hazardous material facilities contain substances that are toxic and which pose a threat to human safety and the environment. These hazardous materials include: corrosives, explosives, flammable materials, radioactive materials, and toxins. The Minnesota Pollution Control Agency (MPCA) keeps a database of potentially contaminated sites and sites where pollution control permits have been issued. Figure 5-15 below depicts MPCA data for Blue Earth County, including active and inactive sites. The MPCA includes a total of 2,845 sites; 1,581 that are active and 1,264 that are inactive.

Figure 5-15: MPCA Contaminated Sites and Environmental Permits[41]

Activity	Description	Active	Inactive
Air Permit	Issued for businesses that create air pollutants typically generated through industrial activities. For example: fine particles, ozone, mercury, etc.	55	12
Construction Stormwater Permit	Issued to construction site owners/operators. Designed to prevent polluted stormwater from reaching lakes, streams and wetlands.	187	354
Construction Stormwater Site Subdivision	Sites where a construction project with an existing stormwater permit has been subdivided into smaller parcels.	100	25
Feedlot	Sites where animals are confined for feeding, breeding, or holding. Ranges from small farms to large-scale commercial livestock operations.	434	77
Hazardous Waste (Small to Minimal Quantity Generator)	Generates less than 2,200 pounds of hazardous waste, or 2.2 pounds of acutely hazardous waste, per calendar month.	378	439

Activity	Description	Active	Inactive
Industrial Stormwater Permit	Issued to industrial site owner/operators. Designed to prevent polluted stormwater from reaching lakes, streams and wetlands. Pollutants may include: toxic metals, oil, grease, de-icing salts, etc.	78	45
Landfill, Permitted By Rule	Landfills that have a small capacity and/or operate for a short period of time that are not required to obtain an individual solid waste permit. For example: yard waste composting facilities, recycling facilities, and energy recovery facilities.	8	0
Leak Site	Locations where a release of petroleum products has occurred from a tank system.	82	128
Tank Site	Sites with a storage tank on the premises. For example: gas stations, bus & trucking companies, factories that process sugar beets, ethanol, pulp, paper, or chemicals, etc.	211	146
Unpermitted Dump Site	Landfills that never held a valid MPCA permit. Generally these dumps existed prior to permitting requirements (pre-1967) and were old farm/municipal disposal sites.	1	17
Voluntary Investigation & Cleanup (VIC) Site	Non-petroleum brownfield sites that are part of the VIC technical assistance program.	8	7
Wastewater Discharger	Facilities that generates or treats wastewater for discharge onto land or into water. Includes: sewage treatment plants and some manufacturers.	39	14

5.2.1.F. ECONOMIC ELEMENTS

Economic elements are the facilities that impact the welfare and stability of the local and/or regional economy. These elements include major employers and financial institutions. Figures 5-16 and 5-17 list the number and type of economic elements identified through the update process.

Figure 5-16: Financial Institutions[42]

Name	Location
Wells Fargo Bank - MSU	620 South Road, Mankato
MinnStar Bank- Mankato	201 Poplar Street, Mankato
Wells Fargo Bank - Main	206 E. Hickory St., Mankato
Wells Fargo Bank - Mankato East	901 Bassett Drive, Mankato
U.S. Bank - City Center	115 E. Hickory Street, Suite 100, Mankato
Frandsen Bank & Trust - Madison Avenue	1580 Madison Avenue, Mankato
U.S. Bank - Raintree	312 Raintree Road, Mankato
Minnstar Bank NA- Lake Crystal	202 North Main Street, Lake Crystal
First National Bank Minnesota - Mankato	500 Long Street, Mankato
Pioneer Bank - Mapleton	301 Main Street NE, Mapleton
Pioneer Bank- Mankato	20 Stadium Road, Suite 100, Mankato
Minnesota Valley Federal Credit Union-Branch	100 Memorial View Court, Mankato

Name	Location
Bremer Bank	1290 Raintree Road, Mankato
United Prairie Bank - City Center	3 Civic Center Plaza, Suite 100, Mankato
Voyager Bank	101 N. Second Street, Mankato
Minnesota Valley Federal Credit Union	P.O. Box 4399, Mankato
Wells Federal Bank - Mankato	1601 Adams Street, Mankato
AgStar Financial Services, ACA	1921 Premier Drive, Mankato
United Prairie Bank	10 Firestone Drive, Suite 100, Mankato
Community Bank Mankato	300 St. Andrews Drive, Mankato
Affinity Plus Federal Credit Union	13 Centennial Student Union, Mankato
TCF National Bank	325 S. Broad Street, Mankato
Northern Star Bank	1650 Madison Avenue, Mankato
ProGrowth Bank	120 N. Augusta Court, Ste. 111, Mankato
TCF Bank Cub West	1200 S. Riverfront Drive, Mankato
ProGrowth Bank - Wal-Mart Super Center	1881 Madison Avenue, Mankato
Community Bank	203 East Main Street, Amboy
St. Clair State Bank	100 West Main Street, St Clair
Citizens Community Federal	1901 E. Madison Ave Suite 410, Mankato
TCF Bank Cub East	1800 Madison Avenue, Mankato
Peoples State Bank of Eagle Lake	405 Parkway Avenue, Eagle Lake
Peoples State Bank of Madison Lake	500 Main Street, Madison Lake
U.S. Bank - Amboy	156 East Maine Street, Amboy

The list below represents the employers in Blue Earth County who employ 250 or more employees, as documented by the Minnesota Department of Employment and Economic Development.

Figure 5-17: Major Employers[43]

Name	Location	Employee Estimate
Mayo Clinic Health System	1025 Marsh St, Mankato	1,000 to 4,999
Minnesota State University	620 South Rd, Mankato	1,000 to 4,999
Mankato Area Public Schools ISD 77	10 Civic Center Plaza, Mankato	1,000 to 4,999
Hickory Tech Corp	221 E Hickory St, Mankato	250 to 499
Mankato Clinic Ltd	1230 E Main St, Mankato	250 to 499
Menards	1771 Premier Dr, Mankato	250 to 499
MRCI Work Source	1611 Monks Ave Mankato	250 to 499
Red Brick Learning	151 Good Counsel Dr, Mankato	250 to 499
Verizon Wireless	2000 Technology Drive, Mankato	250 to 499
Wal-Mart Supercenter	1881 Madison Ave, Mankato	250 to 499

5.2.1.G. HISTORICAL, CULTURAL AND NATURAL RESOURCE AREAS

Community elements in this category are important for their historical and/or cultural significance and natural resources. There are a variety of parks within the county. These facilities are summarized in Figure 5-18.

Figure 5-18: Park Facilities in Blue Earth County[44]

Owner	Park Name	Location	Replacement Value
Blue Earth County	Bray Park & Campground	62336 Osprey Ln, Madison Lake	$1,788,100
	Daly Park & Campground	11055 571ST Ln, Mapleton, MN	$392,200
	Duck Lake Park	61861 232nd Lane, Madison Lake, MN	$400,300
	Hungry Hollow Stop	58490 195th St., Mankato	NA
	Indian Lake Conservation Area	19959 Indian Lake Rd. Mankato	$272,000
	Lake George Park	60446 239TH ST, Madison Lake	$205,400
	Lone Pine Park	21928 Oriole Rd. , Madison Lake	$11,200
	Rapidan Dam Park & Campground	54116 Glory Lane, Mankato	$29,800
	Red Jacket Trail Park	19983 State Hwy 66, Mankato	$42,000
	Schimek Park	15834 557th Ln., Good Thunder	$101,800
	Watonwan Stop	16477 Deerwood Rd., Garden City	$14,400
	Weagel Park	20612 Indian Lake Rd. , Mankato	$69,900
	Wildwood Park	60582 200th Ln., Eagle Lake	$64,200
	Williams Nature Center	54988 State Hwy 68, Mankato	$150,000
City of Mankato	Alexander	900 E Main Street	$349,100
	Bienapfl	1401 4th Avenue	$109,000
	Buscher, F.A.	409 Ledlie Lane	$510,300
	Carney	10 Indian Creek Road	$11,500
	Clair's Creek	433 Diamond Creek Road	$10,400
	Columbia	2022 5th Avenue	$27,000
	Country Club Park	109 Pebble Creek Drive	$178,000
	Dotson	101 Oak Knoll Boulevard	$40,000
	Emerson Park	100 Emerson Ln	$110,200
	Erlandson	101 N Belmont Drive	$622,300
	Franklin Rogers	601 Reed Street	$1,661,600
	Heritage Estates	110 W Welcome Avenue	$110,700
	Highland	950 Warren Street	$671,500
	Hiniker Pond	300 Butterworth Street	$196,800
	Hubbard	606 S Broad Street	$283,100
	Jackson	151 E Jackson Street	$69,000
	Jaycee	147 Jaycee Court	$3,708,300
	Kiwanis Recreation Area/Riverside Park	Highway 169	$81,800
	Land of Memories	300 Amos Owen Lane	$423,800

Owner	Park Name	Location	Replacement Value
	Liberty Place	1100 S Front Street	$10,000
	Lincoln	200 Lincoln Street	$12,500
	Lion's	491 Homestead Drive	$54,000
	Minnesota River Trail	Main Street and Riverfront Drive	$117,300
	Peace Pipe	2401 Fair Street	$42,700
	Pioneer	1400 N 6th Street	$15,000
	Premier Pond and Trail	1931 Premier Drive	$17,200
	Rasmussen Woods	555 Stoltzman Road	$213,300
	Reconciliation Park	100 N Riverfront Drive	$55,300
	Riverfront Park	310 W Rock Street	$595,500
	Sakatah Trail	Lime Valley Road	$13,700
	Sibley	900 Park Lane	$7,417,800
	Southview	1201 Stoltzman Road	$95,500
	Stoltzman	521 W Pleasant Street	$17,400
	Thomas	100 Thomas Park Court	$2,895,600
	Tourtellotte	300 E Mabel Street	$1,144,700
	Vietnam Memorial	215 N 4th Street	$104,000
	Washington	1300 Woodland Avenue	$70,600
	West Mankato Trail	South Riverfront Drive and Popular	$98,100
	Willard Parkway	700 Glenwood Avenue	$26,600
City of Madison Lake	Lindbergh Park	Northwest corner of the City	NA
	North Shore Park	Southwest side of Madison Lake	NA
	Fasnacht Park	Northeast side of the City	NA
	Pines Park	Northeast side of the City in the Pines Subdivision	NA
	Point Pleasant Campground	400 Sheppard Circle	$990,600
	The Boat Landing	805 Main	$808,800
City of Mapleton	Heritage Park	On Central Avenue between Troendle Street and Lincoln Street	$304,400
	Library Park	Main Street between 1st Avenue and Central Avenue	$143,100
	Proehl Park	On the corner of Highway 30 and Second Ave SE, across from the Liquor Store	$2,800
City of St. Clair	Memorial Park	Miller Lane	$188,400
City of Eagle Lake	Lake Eagle Park	100 Thomas Dr	$808,800
	Keith Fraze Memorial Park	105 Cate Street.	$72,000

The following is a list of historic structures within Blue Earth County that are registered on the National Registry of Historic Places.

Figure 5-19: Registered Historic Structures[45]

Name	Address
Blue Earth County Courthouse	204 South 5th St, Mankato
J.R. Brandrup House	704 Byron, Mankato
Charles Chapman House	418 McCauley, Mankato
Lorin Cray House	603 S. 2nd St., Mankato
Dodd Ford Bridge	County Road 147 over the Blue Earth River, Shelby Township
Adolph O. Eberhart House	228 Pleasant St., Mankato
Federal Courthouse and Post Office	401 S. 2nd St., Mankato
First Baptist Church	U.S. Route 169, Garden City Township
First National Bank of Mankato	229 S. Front St., Mankato
First Presbyterian Church	Hickory and S. Broad Sts., Mankato
James P. Gail Farmhouse	Off U.S. Route 169, Lake Crystal
Renesselaer D. Hubbard House	606 S. Broad St., Mankato
William Irving House	320 Park Lane, Mankato
Jones-Roberts Farmstead	Minnesota Highway 68, Lake Crystal
Kern Bridge	Township road over the Le Sueur River, Skyline
Lincoln Park Residential Historic District	Roughly bounded by Shaubut, Record, Pleasant, 2nd, Liberty, Parsons, Lock, and Bradley Sts. and Grace and Wickersham Cts., Mankato
Main Street Commercial Buildings	Main St., Mapleton
Former Mankato Public Library and Reading Room	120 S. Broad, Mankato
Mankato Union Depot	112 Pike St., Mankato
Mapleton Public Library	104 1st Ave., NE., Mapleton
Marsh Concrete Rainbow Arch Bridge	County Road 101 over the Little Cottonwood River, Courtland
Minneopa State Park WPA/Rustic Style Historic Resources	Off U.S. Route 169 west of Mankato
North Front Street Commercial District	301-415 N. Riverfront Dr., Mankato
Old Main, Mankato State Teachers College	5th St., S., and Jackson St., Mankato
Seppman Mill	Minnesota Highway 68 in Minneopa State Park, Skyline
Sterling Congregational Church	County Road 151, Amboy
Lucas Troendle House	2nd and Silver Sts., Mapleton
Zieglers Ford Bridge	Township Road 96 over the Big Cobb River, Good Thunder

5.2.1.H. VULNERABLE POPULATIONS

Vulnerable populations are those citizens and residents that may require special assistance after a hazard event. These populations include children, the elderly, hospitalized persons, and non-English speaking persons. Figure 5-20 lists the number and type of vulnerable populations identified through the update process.

Figure 5-20: Vulnerable Populations[46]

Population Type	Population Number	Percent of Total Population
Children	16,401	25.60%
Elderly	7,562	11.70%

Hospitalized[47]	272	N/A
Non-English Speaking[48]	423	2.40%

Figure 5-21: Nursing Homes and Assisted Living Facilities[49]

Facility Name	Location	Replacement Value
Autumn Grace	118 Raven Court, Mankato	$2,098,400
Cedar Haven	630 Reed Street, Mankato	$839,200
Crystal Seasons Living Community	222 South Murphy Street, Lake Crystal	$5,144,500
Ecumen - Country Neighbors	511 West Blue Earth Street, Lake Crystal	$1,076,200
Ecumen - Country Neighbors	206 Third Ave NE, Mapleton	$685,700
Hillcrest Health Center	714 Southbend Ave., Mankato	$1,153,700
Keystone Communities	100 Dublin Road, Mankato	$3,916,800
Laurels Peak Assisted Living	77 Stadium Road, Mankato	$4,292,800
Mapleton Community Home	301 Troendle St. SW, Mapleton	$2,210,000
Oaklawn Health Care Center	201 Oaklawn Ave., Mankato	$1,766,000
Old Main Village	301 South Fifth Street, Mankato	$2,500,900
Pathstone Living	718 Mound Ave., Mankato	$5,341,500
Primrose Of Mankato	1360 Adams Street, Mankato	$4,855,200
Sterling House Of Mankato	100 Teton Lane, Mankato	$572,200
Sunrise Cottage of Mankato	300 Bunting Lane, Mankato	$523,200

5.2.2 VULNERABILITY ASSESSMENT BY JURISDICTION

Each individual jurisdiction within the county was asked to complete a survey gauging their vulnerability to each of the hazards identified in the plan. Figure 5-25 through 5-35 presents the critical facilities in each jurisdiction. Jurisdictions were asked to both assess the probability that a hazard might affect their jurisdiction as well as the severity or impact that the hazard could potentially have if it did. These surveys were completed by a variety of stakeholder groups including cities, townships, county staff, and individual private stakeholders. The overall ratings for each hazard were averaged out to give a county wide total.

The following tables show the rating given by each city for both probability and impact. The scale given for probability was High, Medium or Low, while Impact was rated on a scale of Significant, Moderate, or Minimal. Hazards highlighted in green are those that represented a lower rating than the county wide average, while those in red represent a higher rating.

Figure 5-22: Probability

HAZARD	Amboy	Eagle Lake	Good Thunder	Lake Crystal	Madison Lake	Mankato	Mapleton	Pemberton	St Clair	Skyline	Vernon Center
Animal and Crop Disease	1	1	3	1	1	1	1	1	1	1	1
Drought	2	1	3	1	1	2	1	1	1	1	1
Earthquake	1	1	1	1	1	1	1	1	1	1	1
Extreme Temperatures	2	1	3	1	1	3	1	1	1	2	2
Flood	2	1	2	1	1	3	1	1	1	2	1
Hail	2	2	2	3	1	3	1	1	2	2	1
Hazardous Material Release	1	1	3	3	1	3	1	1	1	1	1
Infectious Disease	1	1	2	1	1	3	1	1	1	1	1
Infrastructure Failure	2	2	2	2	1	2	1	1	2	1	2
Invasive Species	1	2	1	1	1	3	1	1	1	1	1
Landslide	1	1	1	1	1	3	1	1	1	1	1
Lightning	2	1	3	3	1	3	1	1	1	2	2
Riverine and Ravine Erosion and Landslides	1	1	3	2	1	3	1	1	1	2	3
Severe Winter Weather	2	2	3	3	1	3	2	2	2	2	2
Sinkholes and Land Subsidence	1	1	2	1	1	3	1	1	1	1	1
Structural Fire	1	1	3	2	1	2	1	1	2	2	1
Terrorism	1	1	1	1	1	1	1	1	1	1	1
Tornadoes	2	1	3	1	1	2	2	1	2	2	1
Water Supply Contamination	2	1	1	1	1	1	1	1	2	1	2
Wildfires	1	1	1	1	1	3	1	1	1	1	1
Windstorms	2	1	2	3	1	3	2	2	2	2	1

Figure 5-23: Impact

HAZARD	Amboy	Eagle Lake	Good Thunder	Lake Crystal	Madison Lake	Mankato	Mapleton	Pemberton	St Clair	Skyline	Vernon Center
Animal and Crop Disease	1	1	1	1	1	1	1	1	1	1	1
Drought	2	2	3	2	1	2	1	1	1	1	1
Earthquake	1	2	3	3	1	3	1	1	1	1	2
Extreme Temperatures	2	1	2	2	1	1	1	1	1	1	2
Flood	1	1	3	2	1	1	1	1	2	2	2
Hail	2	1	3	1	1	1	2	1	1	2	2

HAZARD	Amboy	Eagle Lake	Good Thunder	Lake Crystal	Madison Lake	Mankato	Mapleton	Pemberton	St Clair	Skyline	Vernon Center
Hazardous Material Release	2	3	3	2	1	2	2	1	1	1	1
Infectious Disease	2	2	2	2	1	1	2	1	1	2	1
Infrastructure Failure	3	2	3	1	1	2	3	1	3	2	2
Invasive Species	2	3	1	1	1	1	3	1	1	1	1
Landslide	1	1	2	1	1	1	1	1	1	1	1
Lightning	1	1	2	1	1	1	1	1	1	2	2
Riverine and Ravine Erosion and Landslides	1	1	3	1	1	1	1	1	1	1	3
Severe Winter Weather	2	2	3	1	1	1	1	1	1	2	2
Sinkholes and Land Subsidence	1	1	2	1	1	1	1	1	1	1	1
Structural Fire	2	1	3	1	1	2	2	1	2	1	1
Terrorism	3	3	1	3	1	3	3	1	1	2	1
Tornadoes	3	2	3	2	2	2	2	2	3	2	3
Water Supply Contamination	3	3	3	2	2	3	3	1	3	2	2
Wildfires	1	2	2	1	1	1	1	1	2	1	1
Windstorms	1	1	2	1	1	2	1	1	2	2	1

Upon completion of the surveys, the steering committee identified several individual hazards that should be combined into larger hazard categories for the purposes of this plan. Figure 5-24 below details these combinations.

Figure 5-24: Hazard Combinations

Individual Hazards	Hazard Category
Extreme Temperatures, Hail, Lightning, Windstorms	Severe Summer Weather
River and Stream Bank Erosion, Landslide	Riverine and Ravine Erosion and Landslides
Structural Fire, Wildfires	Fire

Figure 5-25: Critical Facilities-City of Amboy

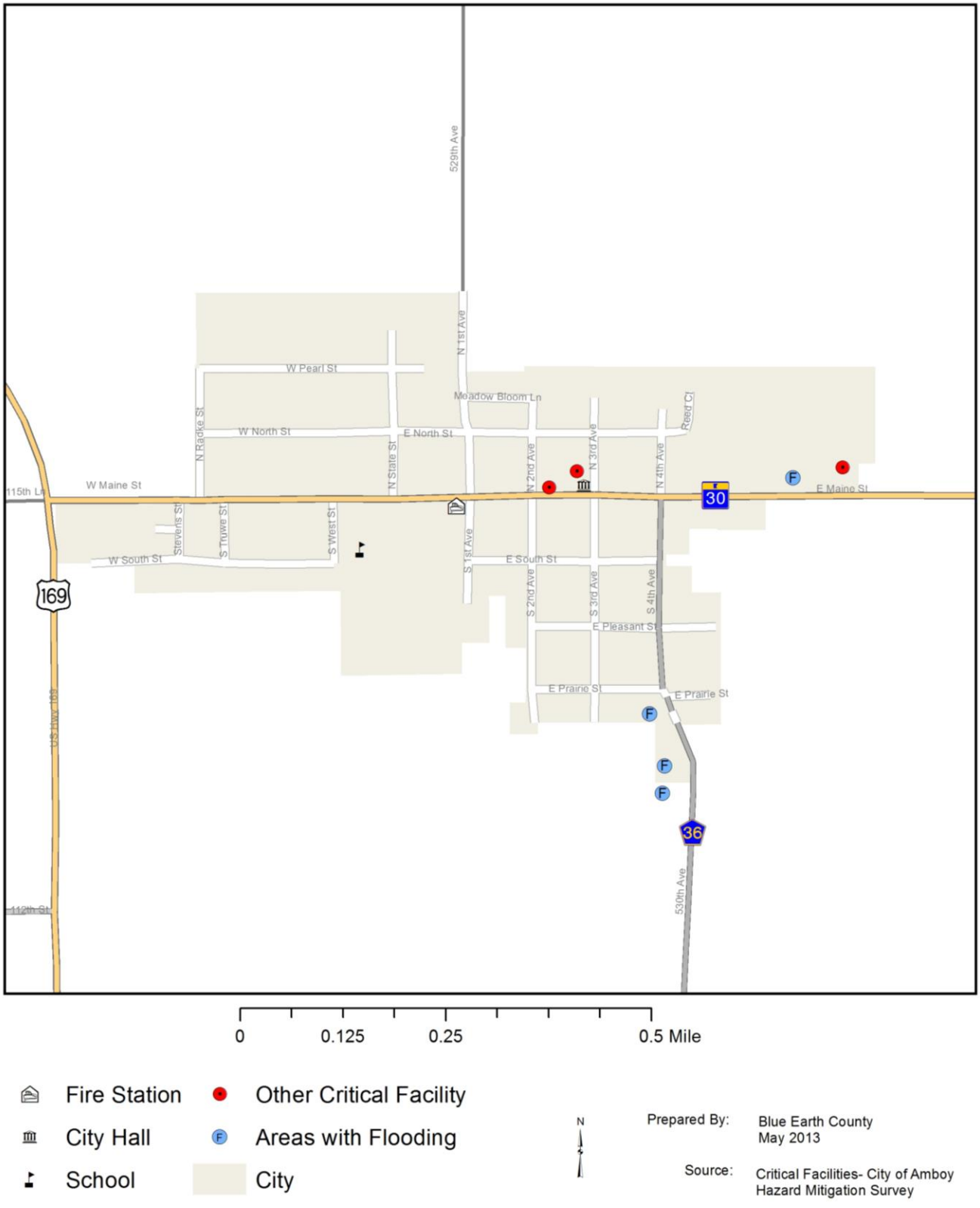


Figure 5-26: Critical Facilities-City of Eagle Lake

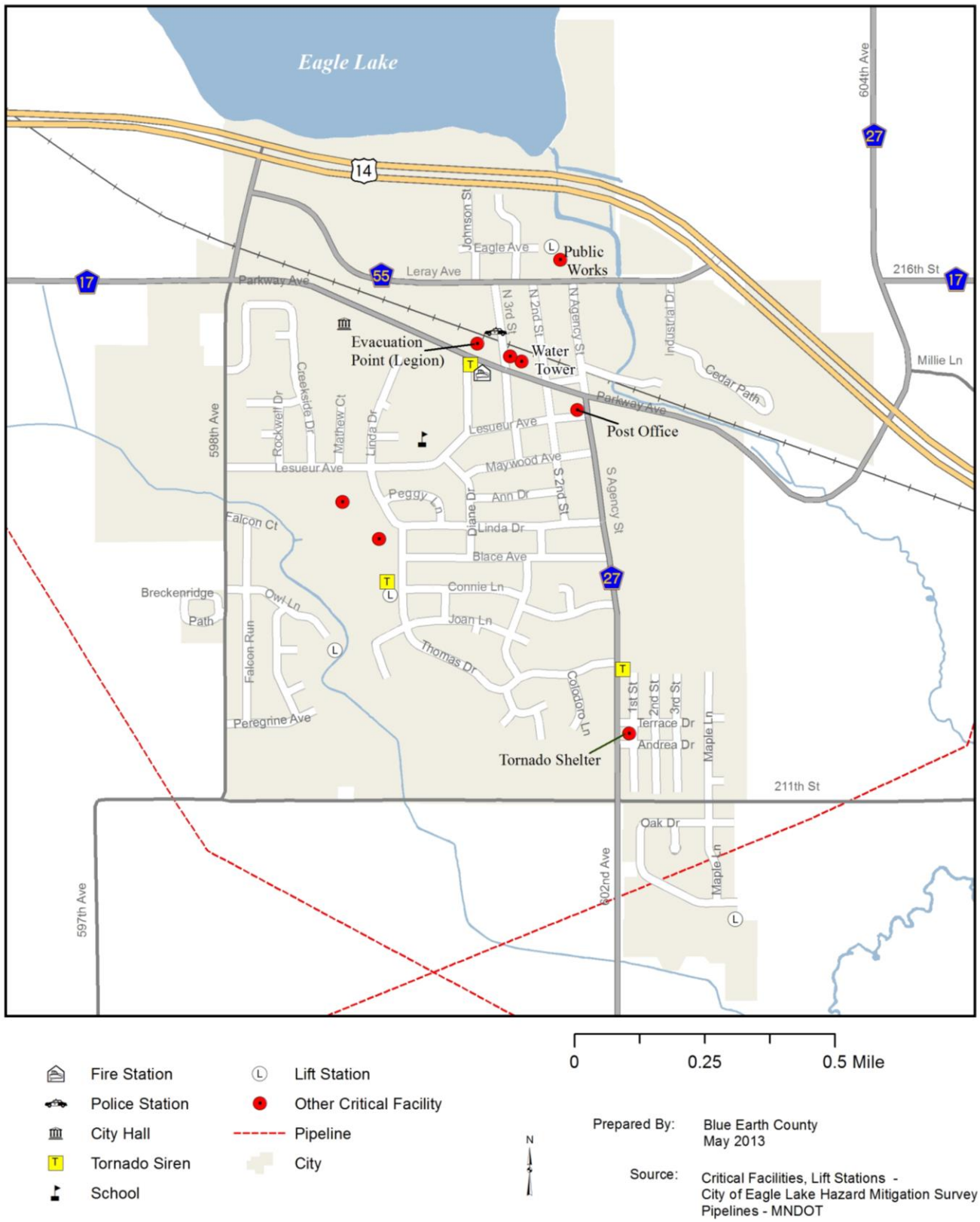


Figure 5-27: Critical Facilities-City of Good Thunder

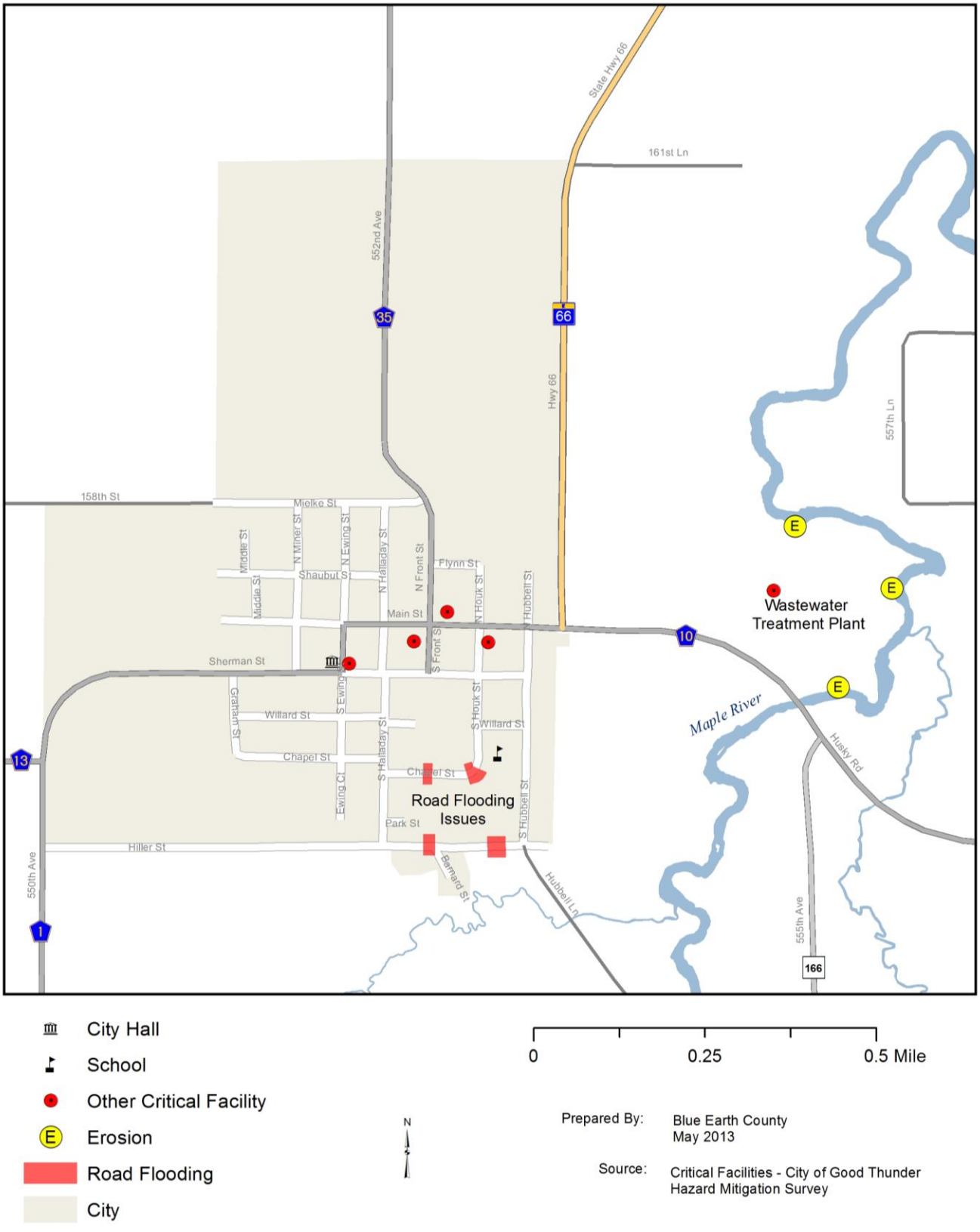


Figure 5-28: Critical Facilities-City of Lake Crystal

City Hall
Police Station
Fire Station
School
Other Critical Facility
Lift Station
City

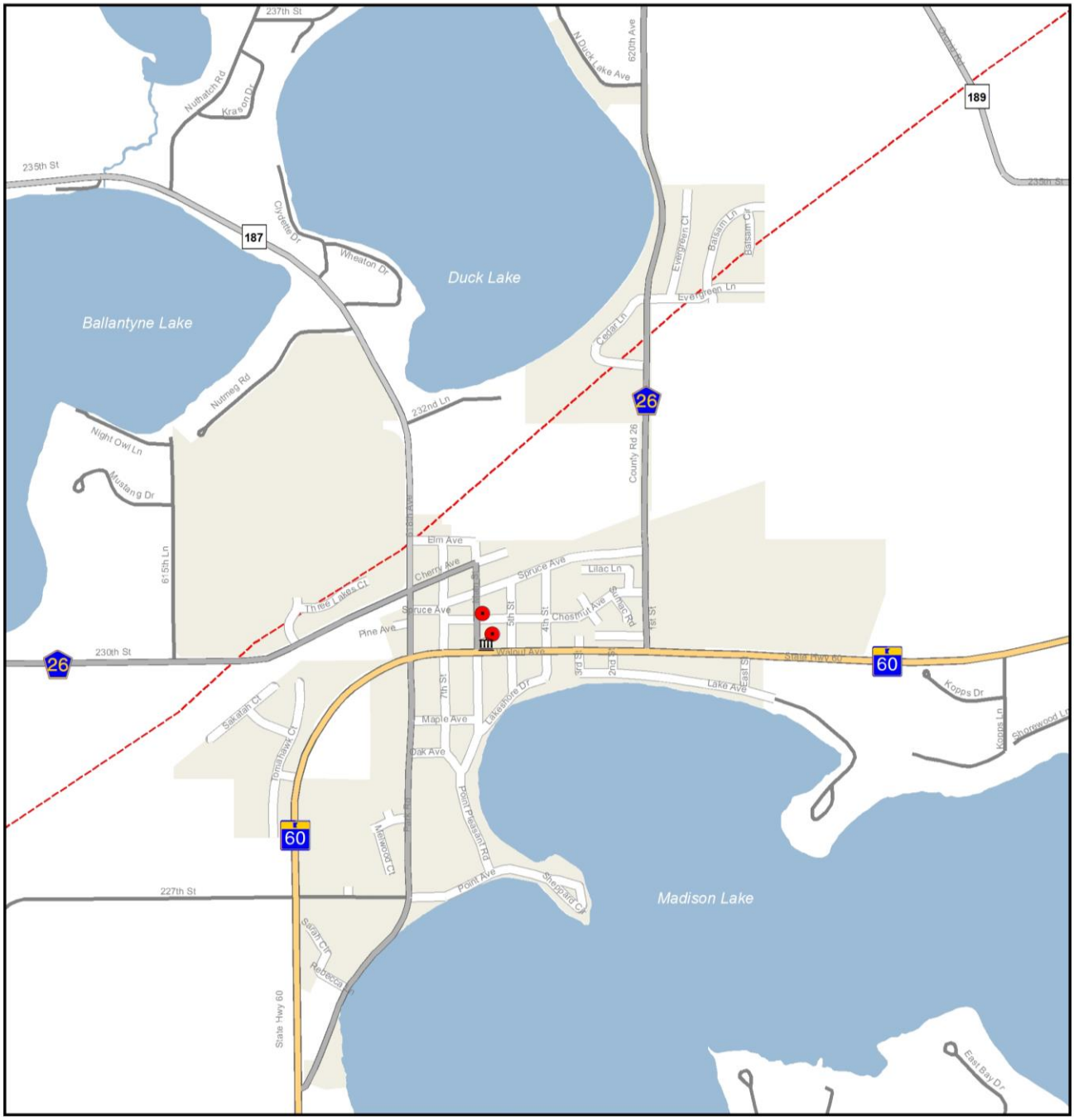
0 0.25 0.5 Mile

N

Prepared By: Blue Earth County
May 2013

Source: Critical Facilities - City of Lake Crystal
Hazard Mitigation Survey

Figure 5-29: Critical Facilities-City of Madison Lake



City Hall
Other Critical Facility
Pipeline
City

Prepared By: Blue Earth County
May 2013

Source: Critical Facilities - City of Madison Lake Hazard Mitigation Survey
Pipelines - MNDOT

Figure 5-30: Critical Facilities-City of Mankato

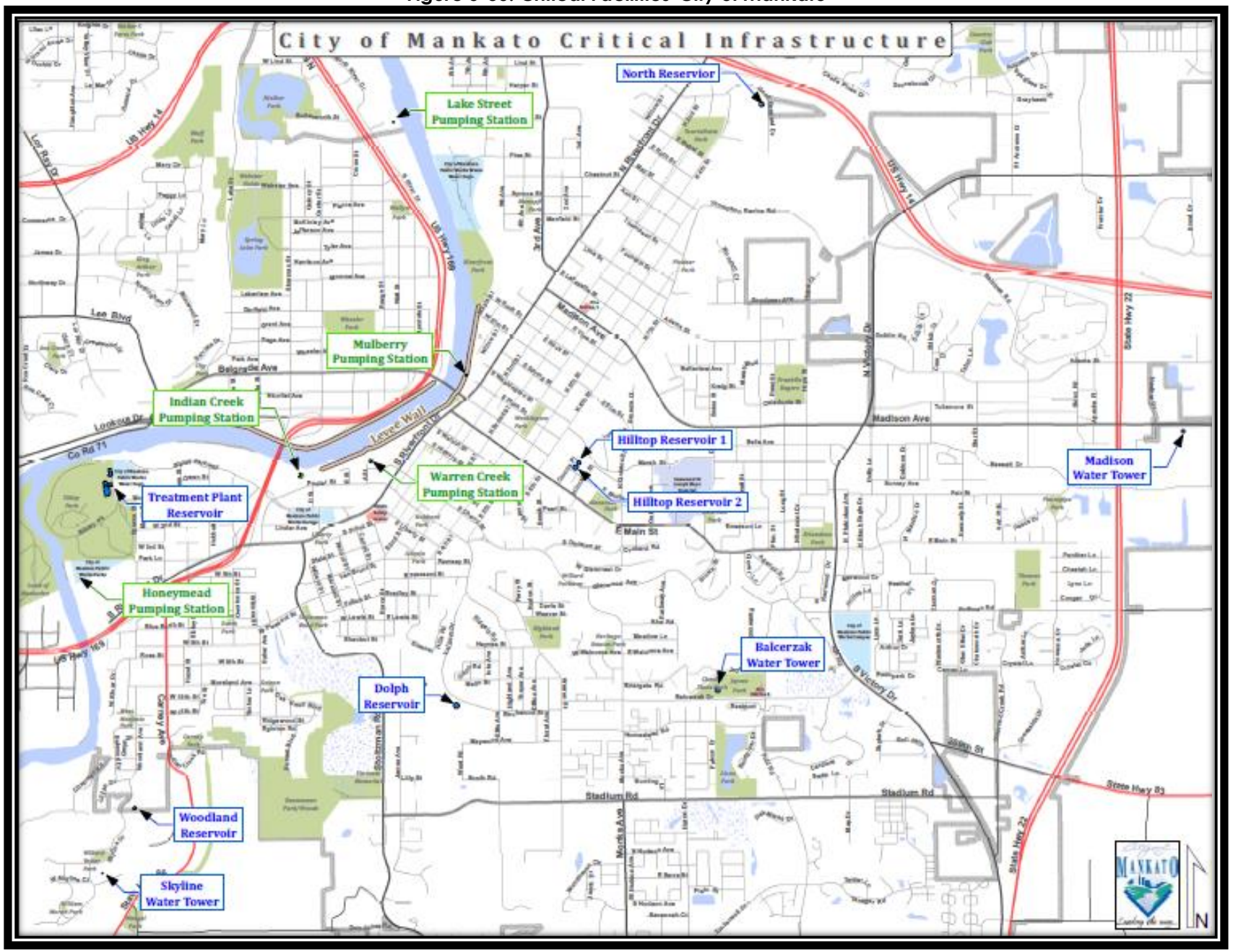


Figure 5-31: Critical Facilities-City of Mapleton

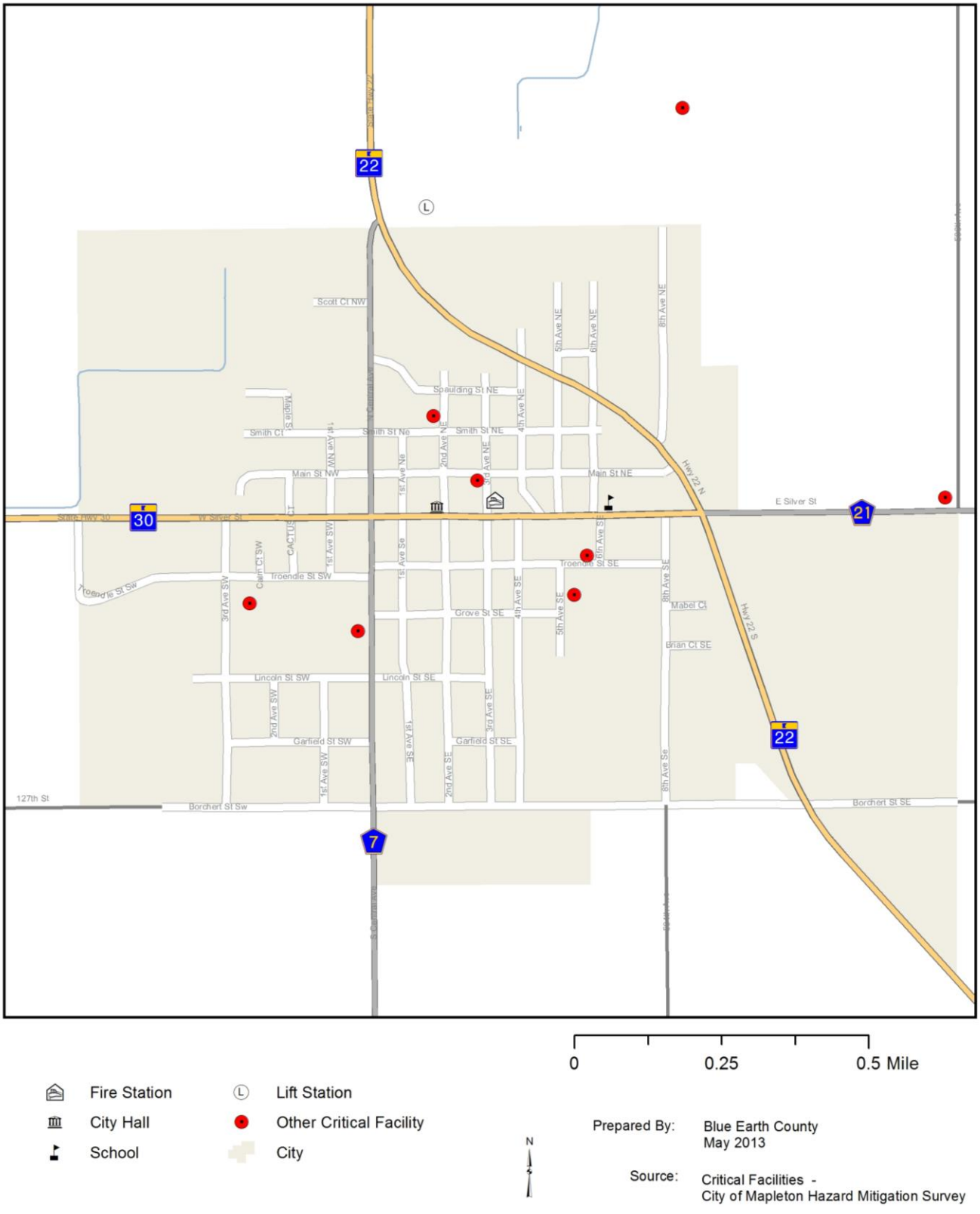
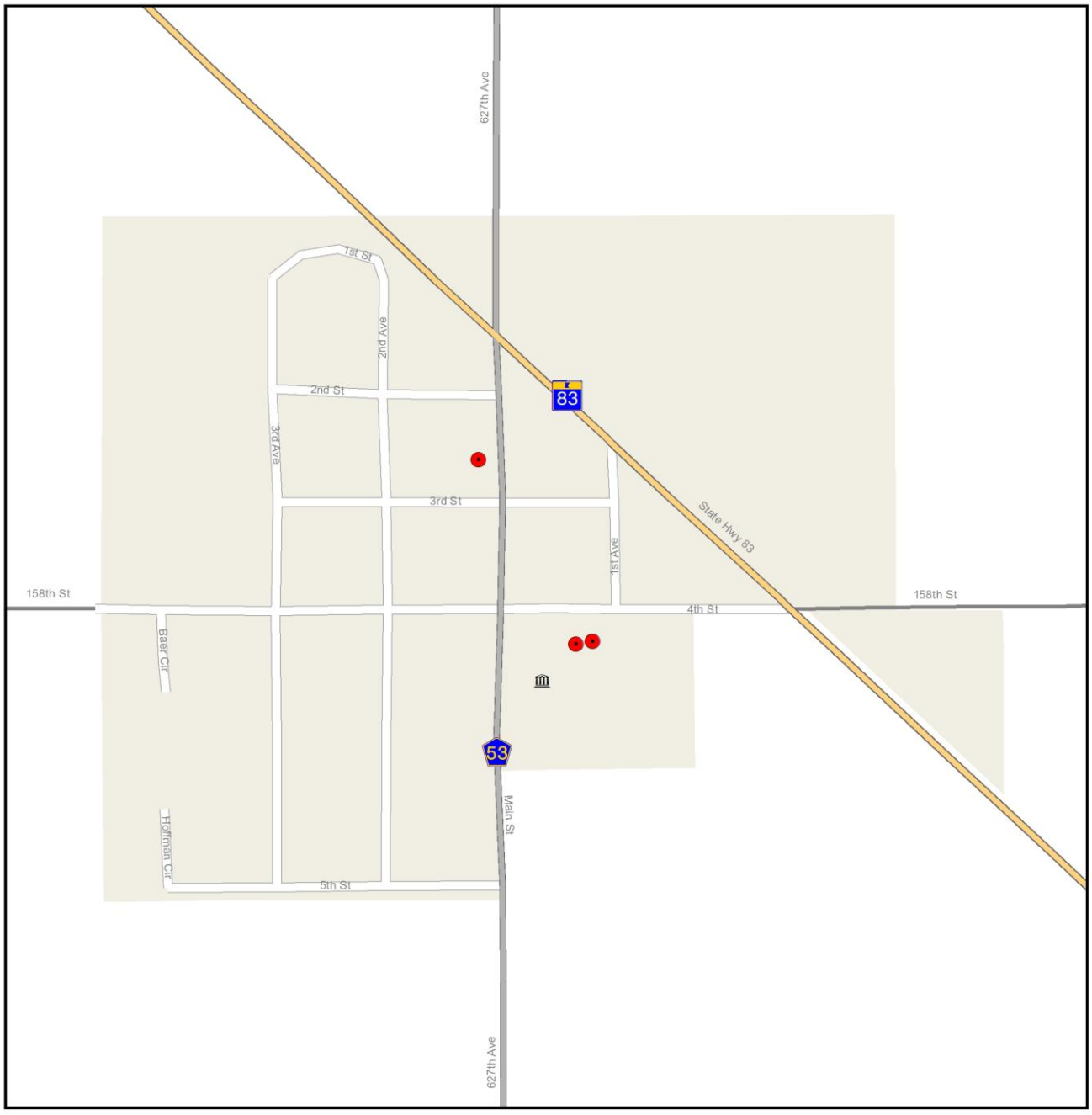


Figure 5-32: Critical Facilities-City of Pemberton



0 0.125 0.25 Mile

City Hall

Other Critical Facility

City

N

Prepared By: Blue Earth County
May 2013

Source: Critical Facilities- City of Pemberton
Hazard Mitigation Survey

Figure 5-33: Critical Facilities-City of Skyline

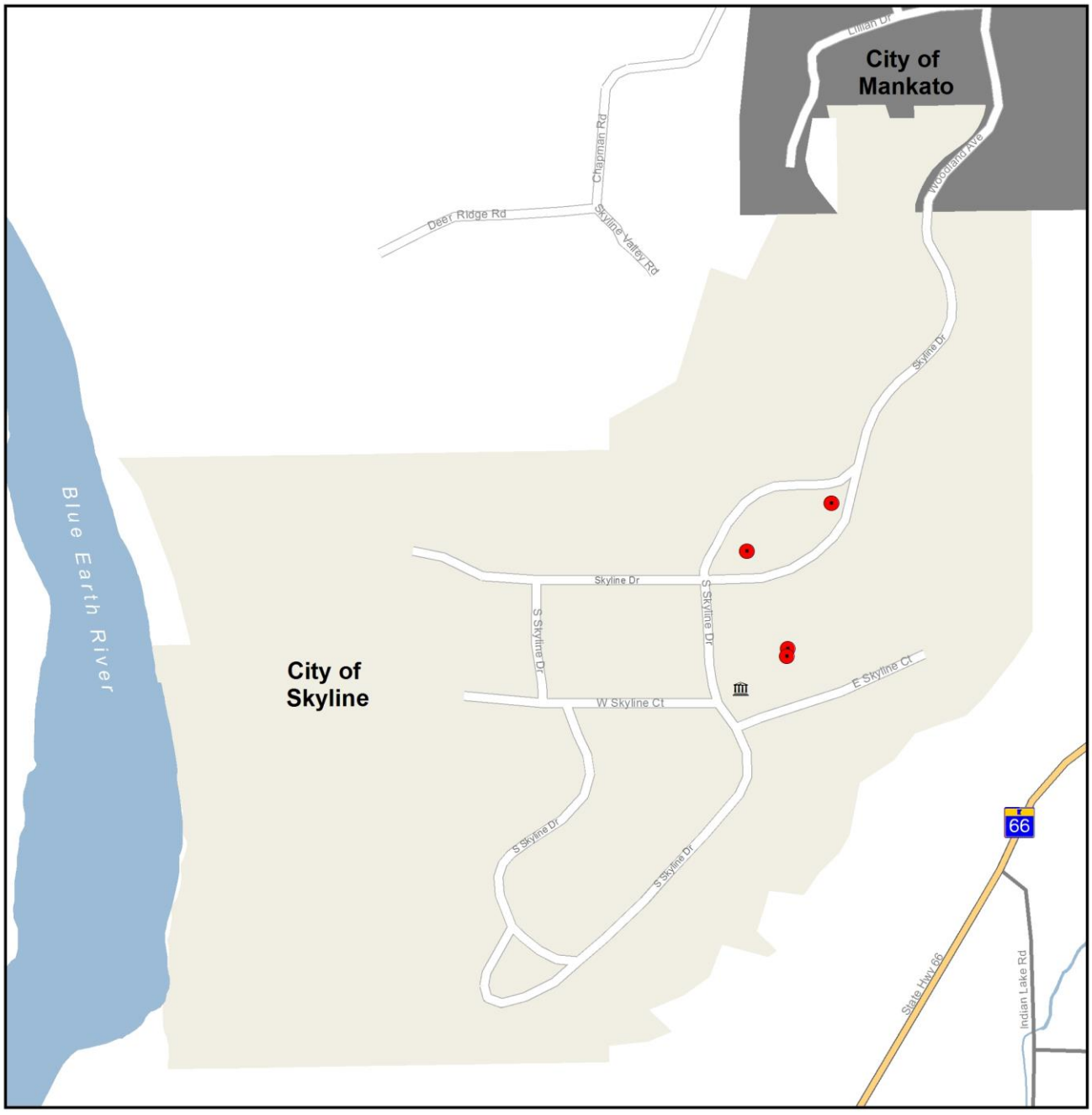


Figure 5-34: Critical Facilities-City of St. Clair

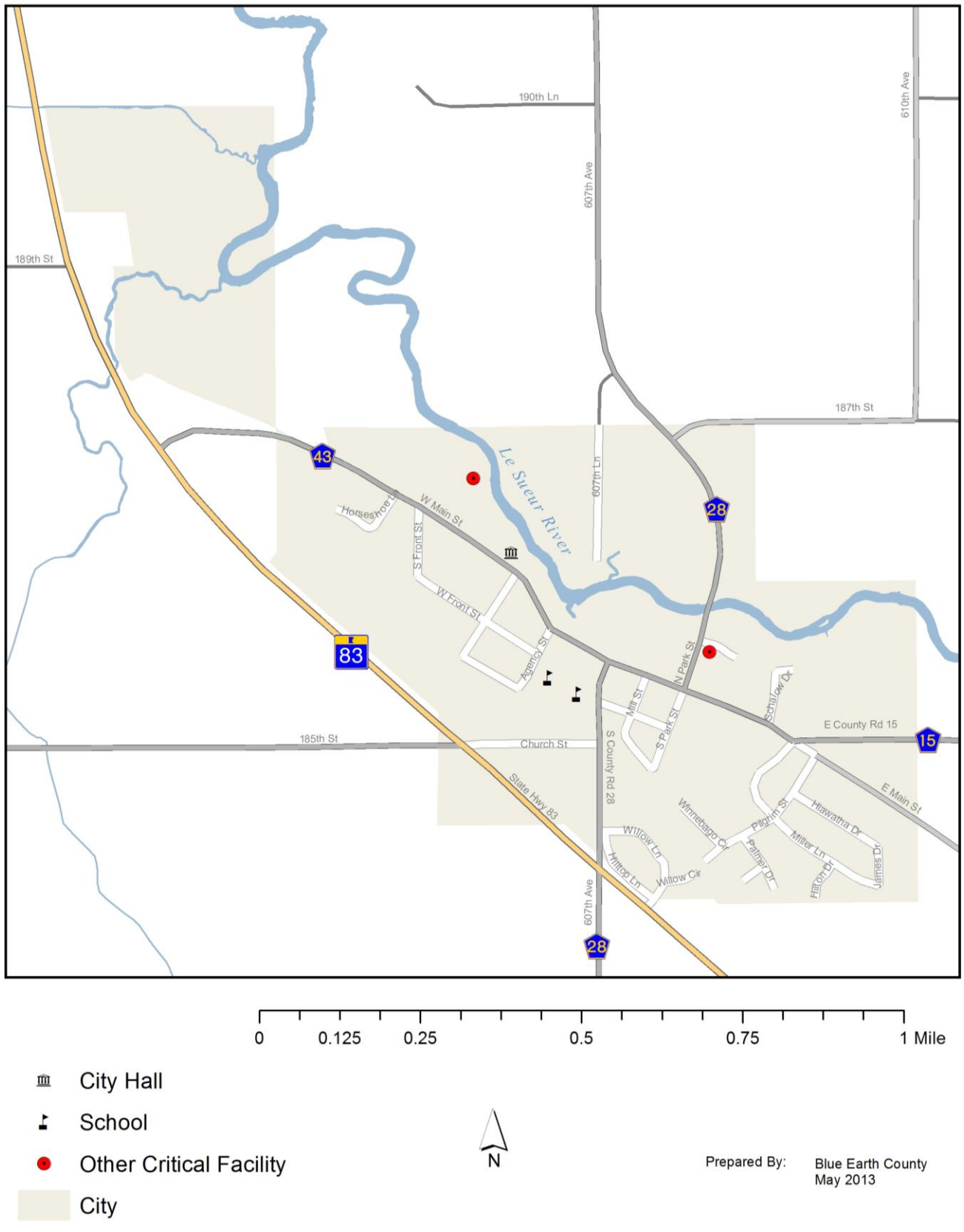
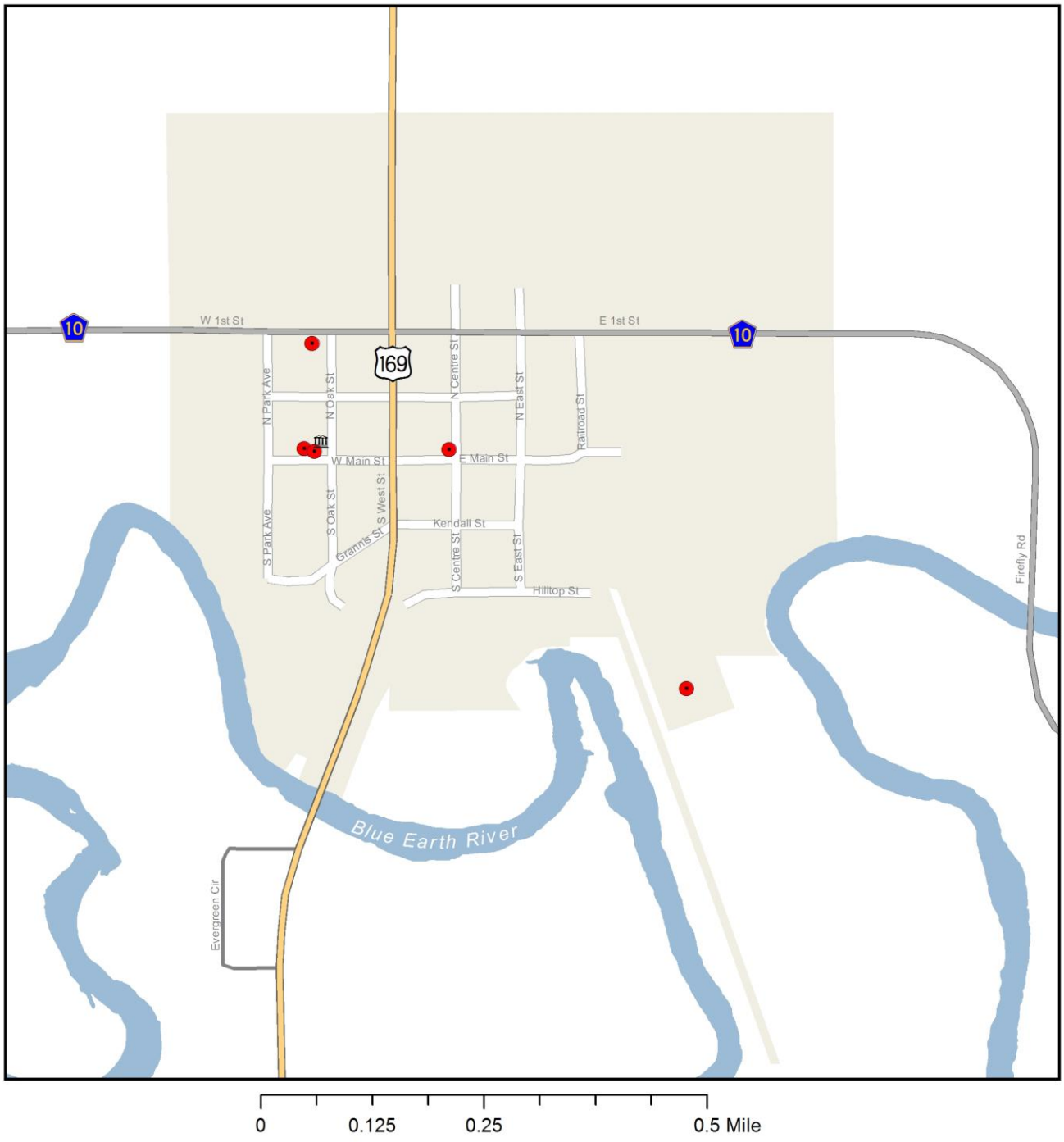


Figure 5-35: Critical Facilities -City of Vernon Center



5.2.3 FUTURE ASSETS & INFRASTRUCTURE

Blue Earth County and the participating cities will continue to utilize their respective governing policy and planning documents in order to mitigate the impact of hazards on future assets and infrastructure. State governing agencies, such as the Minnesota Department of Health, Minnesota Department of Transportation, and the Minnesota Department of Natural Resources will be contacted when appropriate.

As part of the development review process, future assets and infrastructure will be evaluated for the hazards identified in this plan in the context of the hazard's geographic location. Hazards which have no specific geographic location, as identified in the hazard profile sections of this document will not be considered. All future assets and infrastructure will be evaluated for flooding concerns as appropriate on a case by case basis.

5.2.4 LAND USES & DEVELOPMENT TRENDS

The geographic location of hazards, as identified in the hazard profile sections, will be considered for future land use and development trends. Content from the Blue Earth County Hazard Mitigation Plan will be incorporated into local governing policy and planning documents as appropriate. If the local governing policy and planning documents incorporate content from this plan, the impact of hazards on land use and development should be mitigated.

5.3 HAZARD PROFILES

The following sections provide insight into hazards which can potentially occur within Blue Earth County. The hazards which are profiled were selected based upon the planning process discussed in Section 5.1: Hazard Identification.

Each hazard profile has:

- A definition
- Documented previous occurrences (if any)
- FEMA declared disasters (if any)
- Specific geographic location of where the hazard could occur (if any)
- Vulnerability analysis

5.3.1 SEVERE WINTER WEATHER

5.3.1.A. HAZARD DEFINITION

For the purposes of this planning process, the definition of Severe Winter Weather was utilized as identified in the Minnesota State All-Hazard Mitigation Plan: Winter storms vary in size and strength and include heavy snowstorms, blizzards, freezing rain, sleet, ice storms and blowing and drifting snow conditions.[50] This definition was distributed to local jurisdictional stakeholders with risk assessment survey materials as part of the Hazard Mitigation Plan updating process.

5.3.1.B. PREVIOUS OCCURRENCES[51]

According to the National Climatic Data Center, between 1993 (earliest recorded data) and 2011, there were 60 severe winter storm events in Blue Earth County. This includes 28 winter storms, 17 occurrences of heavy snow, 10 blizzards, three ice storms, one occurrence of blowing snow, and one winter weather occurrence. During this period, severe winter storms caused one death and zero injuries. The death occurred as a result of a winter storm on December 23, 1996. There were no recorded damages as a result of severe winter storms during this period.

Figure 5-36: History of Severe Winter Storms

Date	Start Location	Time	Type	Deaths
11/24/1993	County-wide	8:00 AM	Heavy Snow	0
12/21/1993	County-wide	3:00 PM	Blowing Snow	0
1/26/1994	County-wide	8:00 PM	Heavy Snow	0
4/28/1994	County-wide	4:00 AM	Heavy Snow And Ice	0
11/27/1994	County-wide	5:00 AM	Heavy Snow/ice	0
3/4/1995	County-wide	12:00 PM	Heavy Snow and blowing Snow	0
12/8/1995	County-wide	1:00 AM	Blizzard	0
1/10/1996	County-wide	1:00 PM	Heavy Snow	0
1/17/1996	County-wide	2:00 PM	Ice Storm	0
1/25/1996	County-wide	2:00 AM	Heavy Snow	0
1/28/1996	County-wide	11:00 PM	Blizzard	0
3/23/1996	County-wide	9:00 PM	Heavy Snow	0
11/14/1996	County-wide	10:00 PM	Ice Storm	0
11/20/1996	County-wide	2:00 AM	Heavy Snow	0
11/22/1996	County-wide	9:00 PM	Heavy Snow	0
12/14/1996	County-wide	1:00 PM	Heavy Snow	0
12/23/1996	County-wide	5:00 AM	Winter Storm	1
1/9/1997	County-wide	3:00 PM	Blizzard	0
1/15/1997	County-wide	4:00 PM	Blizzard	0
1/22/1997	County-wide	4:00 AM	Winter Storm	0
1/4/1998	County-wide	2:00 PM	Ice Storm	0
1/1/1999	County-wide	11:00 AM	Heavy Snow	0
1/17/1999	County-wide	9:00 PM	Winter Storm	0
3/8/1999	County-wide	12:30 AM	Winter Storm	0
1/19/2000	County-wide	5:30 AM	Heavy Snow	0
1/29/2001	County-wide	7:00 PM	Winter Storm	0

Date	Start Location	Time	Type	Deaths
2/24/2001	County-wide	5:00 PM	Winter Storm	0
3/11/2001	County-wide	11:00 PM	Heavy Snow	0
2/9/2002	County-wide	7:00 AM	Winter Storm	0
3/8/2002	County-wide	6:00 PM	Winter Storm	0
3/14/2002	County-wide	8:00 AM	Winter Storm	0
2/11/2003	County-wide	11:00 AM	Blizzard	0
11/22/2003	County-wide	6:00 PM	Winter Storm	0
12/9/2003	County-wide	3:00 AM	Winter Storm	0
1/24/2004	County-wide	9:00 PM	Winter Storm	0
2/1/2004	County-wide	2:00 AM	Winter Storm	0
3/5/2004	County-wide	12:00 AM	Winter Storm	0
1/1/2005	County-wide	10:00 AM	Winter Storm	0
1/21/2005	County-wide	10:00 AM	Blizzard	0
3/18/2005	County-wide	12:00 AM	Winter Storm	0
12/13/2005	County-wide	8:00 PM	Heavy Snow	0
3/12/2006	County-wide	12:00 PM	Winter Storm	0
11/9/2006	County-wide	23:30 PM	Heavy Snow	0
12/31/2006	County-wide	7:30 AM	Winter Storm	0
1/14/2007	County-wide	14:30 PM	Heavy Snow	0
2/23/2007	County-wide	23:00 PM	Winter Storm	0
3/1/2007	County-wide	12:00 AM	Winter Storm	0
12/1/2007	County-wide	7:30 AM	Winter Storm	0
12/20/2008	County-wide	10:00 AM	Blizzard	0
10/12/2009	County-wide	3:00 AM	Winter Weather	0
12/8/2009	County-wide	8:00 AM	Blizzard	0
12/23/2009	County-wide	17:00 PM	Winter Storm	0
1/25/2010	County-wide	9:00 AM	Blizzard	0
1/25/2010	County-wide	9:00 AM	Winter Storm	0
11/12/2010	County-wide	22:00 PM	Winter Storm	0
12/3/2010	County-wide	10:00 AM	Winter Storm	0
12/10/2010	County-wide	19:00 PM	Blizzard	0
12/20/2010	County-wide	7:30 AM	Winter Storm	0
1/30/2011	County-wide	21:00 PM	Winter Storm	0
2/20/2011	County-wide	7:00 AM	Winter Storm	0
TOTAL				**1**

5.3.1.C. FEMA DECLARED DISASTERS

There have been two Federal Disaster Declarations related to Severe Winter Weather that have included Blue Earth County. See Figure 5-37 below.

Figure 5-37: Disaster Declarations related to Severe Winter Storms

Type	Declaration Date	Declaration Number	Assistance Type
Ice Storm	12/26/1991	DR-929	Public
Severe Winter Storms/Blizzards	1/16/1997	DR-1158	Public

5.3.1.D. GEOGRAPHIC LOCATION

The entire county is at risk from severe winter weather. Rural parts of the county are at a higher risk for disruption of services, as the larger stretches of road required for mobility present a greater challenge to clear in the aftermath of a severe winter weather event.

5.3.1.E. HAZARD EXTENT

The extent of the hazard varies according to several factors, including the intensity, timing, and duration of the event. Additionally, the nature of severe winter weather means that as the frequency of the hazard occurs the extent become greater, as each event has a cumulative effect on the county.

5.3.1.F. VULNERABILITY ANALYSIS

Severe winter weather can occur within any area in the county. As such, the entire county population and all buildings are vulnerable to severe winter weather. To accommodate this risk, this plan will consider all buildings located within the county as vulnerable. The existing buildings and infrastructure in Blue Earth County are discussed in Section 5.2.

- ***Critical Facilities***

The greatest risk to critical facilities from severe winter weather is how the hazard can impact response times and recovery from other hazard events. If a fire, hazardous material release, or other significant hazard occurred in the midst of a blizzard or ice storm, emergency response time would be greatly increased and the damage from the event would be much higher.

5.3.2 EARTHQUAKE

5.3.2.A. HAZARD DEFINITION

For the purposes of this planning process, the definition of Earthquake was utilized as identified in the Minnesota State All-Hazard Mitigation Plan: An earthquake is a sudden motion or trembling caused by an abrupt release of accumulated strain in the tectonic plates that comprise the earth's crust.[52] There are many potential secondary hazards related to an earthquake event, such as surface faulting, sinkholes, and landslides. This definition was distributed to local jurisdictional stakeholders with risk assessment survey materials as part of the Hazard Mitigation Plan updating process.

Earthquakes are assessed in terms of magnitude and intensity. Magnitude is expressed on the Richter scale and is a measure of the amplitude of the largest seismic waves caused by a particular earthquake. Intensity is expressed on the Modified Mercalli Intensity (MMI) scale and is a subjective measure of the earthquake's effects at a certain location. While an earthquake has only one magnitude, its intensity varies by location.[53] See Figure 3-38 for a comparison of magnitude and intensity.

Figure 5-38: Earthquake Magnitude and Intensity[54]

Magnitude (Richter)	Intensity (MMI)	Description of Potential Effects
1.0 - 2.9	I	**I.** Not felt except by a very few under especially favorable conditions.
3.0 - 3.9	II – III	**II.** Felt only by a few persons at rest, especially on upper floors of buildings. **III.** Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibrations similar to the passing of a truck. Duration estimated.
4.0 - 4.9	IV – V	**IV.** Felt indoors by many, outdoors by few during the day. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motor cars rock noticeably. **V.** Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.
5.0 - 5.9	VI – VII	**VI.** Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight. **VII.** Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken.
6.0 - 6.9	VII – IX	**VIII.** Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned. **IX.** Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.

Magnitude (Richter)	Intensity (MMI)	Description of Potential Effects
7.0 and higher	VIII or higher	**X.** Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent. **XI.** Few, if any (masonry) structures remain standing. Bridges destroyed. Rails bent greatly. **XII.** Damage total. Lines of sight and level are distorted. Objects thrown into the air.

5.3.2.B. PREVIOUS OCCURRENCES[55]

There have been no previous occurrences of earthquakes with an epicenter in the county. Since 1860, there have been 20 recorded earthquakes in Minnesota. The two closest events occurred near the cities of New Prague (1860; magnitude 4.7) and New Ulm (1881; magnitude 3.5).

5.3.2.C. FEMA DECLARED DISASTERS

There have been no FEMA declared disasters related to earthquakes that have included Blue Earth County.

5.3.2.D. GEOGRAPHIC LOCATION

There is the potential for an earthquake to occur anywhere within the county and within neighboring counties, although as the historical record reflects no part of Blue Earth County is at a particularly high risk from an earthquake.

5.3.2.E. HAZARD EXTENT

The extent of the damage that may be caused by an earthquake depends on the depth, location, and magnitude of the event. Other influential factors include the quality and design of the built environment and the composition of the ground.

5.3.2.F. VULNERABILITY ANALYSIS FOR EARTHQUAKE HAZARD

- ***Critical Facilities***

All critical facilities in the county would be vulnerable to damage if an earthquake occurred. This includes both structural damage to the facility itself and any secondary damage that might occur with the earthquake's relationship to other hazards. Given the risk of building collapse in denser areas, the urbanized areas of the county are at a higher risk than others. Especially concerning would be an earthquake triggering a hazardous material release. Given the disruption that would occur to essential services and transportation infrastructure if the earthquake was of sufficient size, it is likely that a hazardous material release of this nature would take significantly longer to mobilize against and evacuation might not be an option.

5.3.3 DROUGHT

5.3.3.A. HAZARD DEFINITION

For the purposes of this planning process, the definition of drought was utilized as identified in the Minnesota State All-Hazard Mitigation Plan: Drought is the result of a natural decline in the expected precipitation over an extended period of time, typically one or more seasons in length.[56] This definition was distributed to local jurisdictional stakeholders with risk assessment survey materials as part of the Hazard Mitigation Plan updating process.

5.3.3.B. PREVIOUS OCCURRENCES

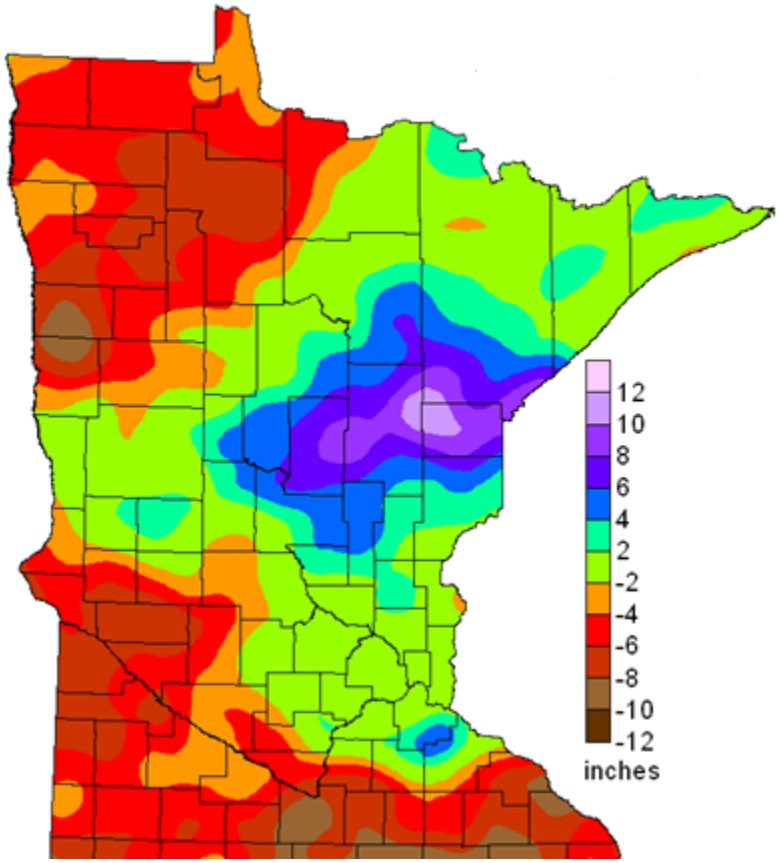
The 2011 Minnesota All-Hazard Mitigation Plan Update and the Minnesota Climatology Working Group have identified the following drought events as having impacted the county. See Figure 5-39 below.

Figure 5-39: Droughts Impacting Blue Earth County[57]

Date	Location	Description
1911-1914	Statewide	Intensity and duration differed locally.
1931-1942	Statewide	Intensity and duration differed locally.
1976-1977	Statewide	Began in 1974 in parts of south-central and western MN. Most severely affected areas were the Otter Tail and Lac Qui Parle River basins. Dry conditions caused lower water levels in wells and caused record low stream flows throughout the state. Late summer forest fires broke out and conflicts arose between domestic well owners and neighboring high capacity well owners.
1987-1989	Statewide	Established new "average low precipitation" and "average high temperature" records. Farmers lost most, if not all, of the year's crop. Drought also affected power production, the forest products industry, public water supplies and fish and wildlife dependent on adequate surface water. Mississippi River flow levels threatened to drop below the Minneapolis Water Works intake pipes.
July 2003 – October 2003	Multiple, south central, southeastern and west-central Minnesota	A persistent weather pattern resulted in extremely dry weather across Minnesota. Few widespread rain events moved through the state during the interval, and precipitation totals were less than six inches across much of Minnesota. During this three month period, rainfall totals rank among the lowest on record for many areas of south central and southeastern Minnesota, and a small portion of west central Minnesota.
September 2011 – Present[58]	Statewide	Beginning in August of 2011, Blue Earth County has witnessed a nearly continuous departure from normal precipitation. This period is actually comprised of two drought events; dry conditions ceased briefly during the spring of 2012. From October 2011 to May 2012 the majority of the county was considered to be in a severe drought. As of August 2012, the north eastern portion of the county was considered to be abnormally dry, the central portion of the county was in a moderate drought, and the south western portion of the county was in a severe drought.

Figure 5-39 shows the current rain shortfall the county and the rest of the state is sustaining. From August 2011 to August 2012, portions of Blue Earth County are around 10 inches departed from normal precipitation.

Figure 5-40: Total Departure from Normal Precipitation August 2011 – August 2012[59]



5.3.3.C. FEMA DECLARED DISASTERS

There have been no Federal Disaster Declarations related to drought that have included Blue Earth County. However, the county was included in one Federal Emergency Declaration related to drought, see Figure 5-41 below.

Figure 5-41: Emergency Declarations Related to Droughts

Type	Declaration Date	Declaration Number	Assistance Type
Drought	6/17/1976	EM-3013	Public

5.3.3.D. GEOGRAPHIC LOCATION

The entire county is at risk from drought.

5.3.3.E. HAZARD EXTENT

The severity of a drought can differ wildly depending on duration, location, and intensity. Regional water supply demands also heavily influence a drought's overall environmental and economic impact. Unfortunately, droughts are often exacerbated by human activities

– i.e. the overuse of water resources through agricultural, industrial, and/or residential consumption. Other weather events, such as heat waves or windstorms, can also increase the severity and impact of a drought immensely. The standard classification system for droughts is given in Figure 5-42, below.

Figure 5-42: Drought Classification Scheme[60]

Category	Description	Possible Impacts
D0	Abnormally Dry	Going into drought: short-term dryness slowing planting, growth of crops or pastures. Coming out of drought: some lingering water deficits; pastures or crops not fully recovered.
D1	Moderate Drought	Some damage to crops, pastures; streams, reservoirs, or wells low, some water shortages developing or imminent; voluntary water-use restrictions requested.
D2	Severe Drought	Crop or pasture losses likely; water shortages common; water restrictions imposed.
D3	Extreme Drought	Major crop/pasture losses; widespread water shortages or restrictions.
D4	Exceptional Drought	Exceptional and widespread crop/pasture losses; shortages of water in reservoirs, streams, and wells creating water emergencies.

5.3.3.F. VULNERABILITY ANALYSIS

Droughts can increase an area's susceptibility to wildfire by increasing the amount of dry vegetative fuel. Vegetation weakened by a lack of sufficient moisture may also be more susceptible to attack by diseases and invasive species. Prolonged drought can result in the loss of vegetation, thereby increasing the risk of erosion during heavy rainfall and flood events.

- ***Critical Facilities***

Drought itself does not pose a significant risk to critical facilities in the County. However, extreme drought can greatly enhance the risk of wildfires which could impact critical facilities.

5.3.4 FIRE

5.3.4.A. HAZARD DEFINITION

For the purposes of this planning process the following definitions were used for Structural Fire and Wildfire: the definition of Structure Fire was utilized as identified in the Minnesota State All-Hazard Mitigation Plan: Fires have many causes: careless smoking, cooking, or campfires, arson, improper building wiring, industrial mishaps, and instances such as train derailments or transportation collisions.[61] This definition was distributed to local jurisdictional stakeholders with risk assessment survey materials as part of the Hazard Mitigation Plan updating process.

The definition of Wildfire was utilized as identified in the Minnesota State All-Hazard Mitigation Plan: A wildfire is an uncontrolled fire spreading through primarily vegetative fuels, exposing and possibly consuming structures.[62] This definition was distributed to local jurisdictional stakeholders with risk assessment survey materials as part of the Hazard Mitigation Plan updating process.

In many situations, fires can occur as the result of other hazards – such as earthquakes, tornadoes, floods, or windstorms. For example, an earthquake may ignite fires by rupturing natural gas distribution systems or downing power lines. However, lightning is by far the most common natural cause of both structural fires and wildfires.

Fires can also contribute to the probability of another hazard occurring. For example, wildfires can strip away vegetation from hillsides, increasing the risk of severe soil erosion, landslides, and flooding. Areas recently cleared by wildfire may also be at increased risk of invasive species. Many industries utilize hazardous materials that are also flammable. Industrial structural fires therefore must be handled with great caution to avoid the compound threat of fire with the potential for hazardous material release.

In other situations various hazards can significantly impair a fire department's ability to fight fires. For instance, a flood may restrict the movement of emergency vehicles by damaging roads and leaving debris on streets, or it may inundate an emergency facility and impair departmental operations.

5.3.4.B. PREVIOUS OCCURRENCES[63]

Between 2002 and 2011 there were 2 wildfires in Blue Earth County. These fires consumed a total of 304.2 total acres of land within the county. Of this total, 0.2 acres were forested and 304 were non-forested.[64]

There have been significantly more structural fires within the County. The following tables show the total number of fire runs performed in the county and in local jurisdictions from 2002-2011.

Figure 5-43: County Fire Data[65]

Year	Blue Earth – COUNTY				
	Total Fire Runs	Total Other Runs	Total Dollar Loss	Fire Rate (one fire per number of persons indicated)	Fire Deaths
2002	258	2,617	$935,950	233	0
2003	266	2,596	$2,664,500	229	1
2004	260	2,595	$995,180	243	0
2005	186	2,866	$959,400	338	0
2006	250	3,233	$3,814,400	256	0
2007	259	3,126	$1,898,925	246	0
2008	292	2,741	$1,975,575	235	0
2009	209	2,643	$478,300	304	1
2010	217	2,626	$2,448,600	288	0
2011	248	2,679	$1,155,725	263	2
Total	2445	27722	$17,326,555	2635	4
Average	244.5	2772.2	$1,732,656	263.5	

Figure 5-44: Local Jurisdictional Fire Data[66]

Year	Amboy		
	Total Fire Runs	Total Other Runs	Total Dollar Loss
2002	9	47	$140,000
2003	5	41	$0
2004	12	44	$0
2005	5	36	$0
2006	8	35	$0
2007	6	33	$255,000
2008	10	28	$0
2009	8	44	$6,000
2010	6	38	$0
2011	12	49	$0
Total	81	395	$401,000
Average	8.1	39.5	$40,100

Year	Eagle Lake		
	Total Fire Runs	Total Other Runs	Total Dollar Loss
2002	16	50	$0
2003	16	70	$0
2004	22	74	$0
2005	13	70	$0
2006	15	93	$0
2007	12	88	$0
2008	13	92	$0
2009	12	103	$0
2010	12	85	$0
2011	6	97	$0
Total	137	822	$0
Average	13.7	82.2	$0

Year	Good Thunder		
	Total Fire Runs	Total Other Runs	Total Dollar Loss
2002	14	76	$8,000
2003	18	58	$10,000
2004	9	47	$86,000
2005	13	52	$130,000
2006	12	59	$18,000
2007	16	52	$11,000
2008	12	79	$26,000
2009	7	52	$1,000
2010	6	51	$41,000
2011	19	55	$75,000
Total	126	581	$406,000
Average	12.6	58.1	$40,600

Year	Lake Crystal		
	Total Fire Runs	Total Other Runs	Total Dollar Loss
2002	16	55	$131,000
2003	16	58	$190,700
2004	19	48	$227,000
2005	9	55	$130,000
2006	12	63	$65,500
2007	11	54	$73,000
2008	20	53	$804,000
2009	22	50	$0
2010	24	56	$188,400
2011	29	62	$187,000
Total	178	554	$1,996,600
Average	17.8	55.4	$199,660

Year	Madison Lake		
	Total Fire Runs	Total Other Runs	Total Dollar Loss
2002	11	61	$200,500
2003	13	55	$153,000
2004	12	51	$205,300
2005	1	6	$200
2006	21	45	$626,000
2007	11	56	$126,000
2008	8	48	$33,000
2009	10	49	$87,500
2010	12	85	$481,800
2011	8	70	$15,000
Total	107	526	$1,928,300
Average	10.7	52.6	$192,830

Year	Mankato		
	Total Fire Runs	Total Other Runs	Total Dollar Loss
2002	132	2,145	$241,450
2003	144	2,116	$2,249,800
2004	140	2,185	$183,880
2005	104	2,397	$657,200
2006	143	2,681	$736,900
2007	150	2,618	$511,925
2008	155	2,196	$799,575
2009	113	2,106	$303,800
2010	119	2,048	$1,524,150
2011	119	2,095	$570,725
Total	1319	22587	$7,779,405
Average	131.9	2258.7	$777,941

Year	Mapleton		
	Total Fire Runs	Total Other Runs	Total Dollar Loss
2002	21	31	$65,000
2003	17	23	$0
2004	16	13	$0
2005	6	122	$0
2006	9	129	$0
2007	14	100	$0
2008	18	102	$0
2009	6	111	$0
2010	9	112	$0
2011	9	110	$0
Total	125	853	$65,000
Average	12.5	85.3	$6,500

Year	Pemberton		
	Total Fire Runs	Total Other Runs	Total Dollar Loss
2002	7	18	$0
2003	3	5	$0
2004	No report	No report	No report
2005	No report	No report	No report
2006	No report	No report	No report
2007	No report	No report	No report
2008	18	13	$0
2009	3	9	$0
2010	1	0	$0
2011	5	10	$0
Total	37	55	$0
Average	6.2	9.2	$0

Year	St. Clair		
	Total Fire Runs	Total Other Runs	Total Dollar Loss
2002	12	91	$9,000
2003	16	118	$0
2004	10	81	$150,000
2005	13	79	$12,000
2006	13	81	$112,000
2007	17	78	$893,000
2008	19	81	$9,000
2009	8	71	$80,000
2010	11	93	$8,250
2011	19	83	$308,000
Total	138	856	$1,581,250
Average	13.8	85.6	$158,125

Year	Skyline		
	Total Fire Runs	Total Other Runs	Total Dollar Loss
2002	0	0	$0
2003	1	0	$40,000
2004	0	0	$0
2005	0	0	$0
2006	0	0	$0
2007	0	0	$0
2008	1	0	$300,000
2009	0	0	$0
2010	0	0	$0
2011	0	0	$0
Total	2	0	$340,000
Average	0.2	0	$34,000

Year	Vernon Center		
	Total Fire Runs	Total Other Runs	Total Dollar Loss
2002	8	14	$0
2003	7	31	$0
2004	3	24	$0
2005	10	26	$0
2006	5	21	$0
2007	4	18	$0
2008	6	23	$0
2009	9	19	$0
2010	5	27	$85,000
2011	7	28	$0
Total	64	231	$85,000
Average	6.4	23.1	$8,500

Year	South Bend Township		
	Total Fire Runs	Total Other Runs	Total Dollar Loss
2002	12	29	$141,000
2003	10	21	$21,000
2004	17	28	$143,000
2005	12	23	$30,000
2006	12	26	$2,256,000
2007	18	29	$29,000
2008	12	26	$4,000
2009	11	29	$0
2010	12	31	$120,000
2011	15	20	$0
Total	131	262	$2,744,000
Average	13.1	26.2	$274,400

5.3.4.C. FEMA DECLARED DISASTERS

There have been no FEMA declared disasters related to fires, either structural or wildfire.

5.3.4.D. GEOGRAPHIC LOCATION

While the entire county is at risk from fire, the level of risk varies by type of fire and the location of the fire. The risk from structural fire is greater in the urban portions of the county, while the risk from wildfire is greater in the rural and natural areas. For example, farm fields and ditches are particularly susceptible to wildfires. The risk from vehicle fires is greatest in the urban areas and along major transportation routes.

The risk from fires is also influenced by location within the county and the proximity to available emergency responders and adequate water for fire suppression. In this sense, rural areas are at a disadvantage in that it will take firefighters longer to reach the fire and upon arrival they may have to rely on water from tanker trucks to suppress the fire. In this regard, rural areas may have a slightly higher level of risk.

5.3.4.E. HAZARD EXTENT

The extent of the damage that may be caused by fires also depends on the type of fire. The damage that may result from structural fires depends on the design, use, and location of the structure, as well as the behavior of those people who may be living or working in the structure. Similarly, the potential for damage from wildfires depends on fuel availability, weather and terrain. The relative lack of sufficient material that will sustain a large wildfire limits the scope of the damage that is possible.

5.3.4.F. VULNERABILITY ANALYSIS

- ***Wildfire***

Urbanized areas within the county have the lowest risk from wildfires. Crop lands and wetlands possess a medium risk, while shrub lands and forested areas have the highest risk in the county.

- ***Structural Fire***

Very low potential areas in the county include croplands, wetlands, shrub lands, forested areas, and open water where structures are not typically found. Low potential areas include low density urban areas where up to 25% of the surface area is impervious. Medium potential areas include more densely settled urban areas where up to 50% of the surface area is impervious. High potential areas include very densely settled land that is covered up to 100% by impervious surfaces. Impervious structures include buildings, bridges, roadways, parking lots, and all other manmade objects.

5.3.5 INFECTIOUS DISEASE

5.3.5.A. HAZARD DEFINITION

For the purposes of this planning process, the FEMA definition of infectious disease was utilized as identified in the Minnesota State All-Hazard Mitigation Plan: Infectious diseases have the potential to affect any form of life. An "epidemic" is defined as a disease that occurs suddenly in numbers clearly in excess of normal expectancy, especially infectious diseases, but is applied also to any disease, injury, or other health-related event occurring in such outbreaks.[67] This definition was distributed to local jurisdictional stakeholders with risk assessment survey materials as part of the Hazard Mitigation Plan updating process.

Infectious diseases pose a risk to public health and wellbeing not only by the primary effects of the illness itself, but also by the potential of public disorder and disruption. If an epidemic strikes at a significantly large scale it can create a general breakdown in societal order and cause significant concerns for public safety.

5.3.5.B. PREVIOUS OCCURRENCES

Blue Earth County has not seen any significant outbreaks of infectious diseases in recent years. Figure 5-45 below shows the recorded incidences of infectious diseases in Blue Earth County from 2003 to 2010[68]. Also shown is the median level of occurrence for the state.

Figure 5-45: Infectious Disease Statistics 2003-2010

Infectious Diseases	BEC	MEDIAN	BEC	MEDIAN	BEC	MEDIAN	BEC	MEDIAN	BEC	MEDIAN	BEC	MEDIAN	BEC	MEDIAN	BEC	MEDIAN
	2003		2004		2005		2006		2007		2008		2009		2010	
Campylobacteriosis	9	3	18	5	6	4	7	3	5	3	6	4	10	5	10	7
Chlamydia	154	17	201	21	224	21	185	23	239	24	212	31	238	30	243	38
Giardiasis	9	4	7	2	7	2	15	2	14	2	5	3	8	2	3	2
Gonorrhea	41	3	41	2	45	2	28	2	20	2	21	3	22	2	15	2
HIV	0	0	2	0	1	0	2	0	1	0	1	0	1	0	3	0
Lyme Disease	0	5	6	2	4	2	6	2	4	2	0	3	5	2	3	4
Salmonellosis	7	3	7	3	8	3	5	2	8	2	5	3	14	2	7	4
Syphilis - All Stages	0	0	0	0	2	0	1	0	0	0	5	0	1	0	1	0
Tuberculosis	1	0	1	0	1	0	0	0	2	0	0	0	0	0	0	0
West Nile	x	x	x	x	x	x	x	x	0	0	0	0	0	0	0	0

As Figure 5-34 shows, Blue Earth County does exhibit a higher than average incident rate for some diseases. Especially notable are Chlamydia and Gonorrhea, for which the County has a significantly higher rate of infection than others.

5.3.5.C. GEOGRAPHIC LOCATION

An infectious disease outbreak can occur anywhere within Blue Earth County. Given the nature of disease transmission, urban areas with more dense populations are more susceptible.

5.3.5.D. HAZARD EXTENT

The hazard extent varies depending on the overall health of the community, the specific characteristics of the disease, the ability of modern medicine to treat and control the disease, and the speed with which a response is mounted to an outbreak.

5.3.5.E. VULNERABILITY ANALYSIS

The risk infectious disease poses to critical facilities is related to how it can impact response times and recovery from other hazard events. Given the nature of the hazard it does not pose a significant risk on its own.

5.3.6 HAZARDOUS MATERIAL RELEASE

5.3.6.A. HAZARD DEFINITION

For the purposes of this planning process, the definition of Hazardous Material Release was utilized as identified by the Environmental Protection Agency's Technical Guidance for Hazard Analysis: A hazardous material is defined as any substance or material in a quantity or form which may be harmful to humans, animals, crops, water systems, or other elements of the environment if accidentally released.[69] Hazardous materials include: explosives, gases (compressed, liquefied, or dissolved), flammable and combustible liquids, flammable solids or substances, oxidizing substances, poisonous and infectious substances, radioactive materials, and corrosives. This definition was distributed to local jurisdictional stakeholders with risk assessment survey materials as part of the Hazard Mitigation Plan updating process.

5.3.6.B. PREVIOUS OCCURRENCES[70]

The National Response Center reports that between January 1, 2005 and May 9, 2013 there were 13 fixed site hazardous material release incidents in Blue Earth County. Figure 5-46 shows the summary of incidents reported including the medium affected as a result of the hazardous materials released.

Figure 5-46: Fixed Sites Hazardous Material Release (Jan. 2005- May. 2013)[71]

Incident Date/Time	Type of Material	Incident Cause	Location	Medium Affected	Suspected Responsible Company
8/23/2006 16:15	Ammonia, Anhydrous	Equipment Failure	St-1 Amonia Storage Tank 16078 Highway 169	Air	Koch Nitrogen Company
2/21/2007 9:45	Ammonia, Anhydrous	Unknown	16082 Us Hwy 169	Air	Enterprize
3/18/2008 9:20	Ammonia, Anhydrous	Equipment Failure	16082 Us Hwy 169	Air	Enterprise Product Operating
7/8/2008 8:30	Gasoline: Automotive (Unleaded)	Equipment Failure	55199 St. Hwy 68	Land	Magellan
12/20/2009 8:30	Phosphonobutane	Operator Error	2001 3rd Ave	Water	ADM
12/20/2009 8:30	Enviroplus Containing Corrosive Liquid	Operator Error	2001 3rd Ave	Water	ADM
12/20/2009 8:30	Tricarboxylic Acid	Operator Error	2001 3rd Ave	Water	ADM
7/26/2010 10:37	Ammonia, Anhydrous	Other	None 16078 Highway 169	Air	Koch Nitrogen Company
8/3/2010 14:21	Ammonia, Anhydrous	Equipment Failure	16078 Hwy 169	Air	Koch Nitrogen Co.
1/11/2011 8:04	Unknown Petroleum Product	Other	Near The Intersection Of Popular And D Streets	Land	N/A
7/21/2011 14:56	Ammonia, Anhydrous	Other	None 16078 Highway 169	Air	Koch Nitrogen Company
3/13/2012 10:35	Ammonia, Anhydrous	Equipment Failure	16078 Highway 169	Other	Koch Nitrogen Company
6/9/2012 9:33	Natural Gas	Unknown	306 Southbend Ave	Air	N/A

The U. S. Department of Transportation reports that between November 27, 1971 and January 31, 2011, 80 events related to the transportation of hazardous materials occurred in the county. Seventy-seven of these events occurred within the City of Mankato, two in Lake Crystal, and one in Garden City. A summary of these events is provided in Figures 5-47 and 5-48 below.

Figure 5-47: History of HAZMAT Transportation Events

Category	Count
Total Events	80
Airplane Related	1
Highway Related	77
Rail Related	2
Occurred during transit phase	11
Occurred during loading phase	6
Occurred during unloading phase	33
Occurred prior to recording of phase	30
Total Evacuations	2
Total Evacuated	175
Required Remediation	25
Resulted in Damages	32
Total Damages	$189,708
Total Injuries	0
Total Deaths	0

Figure 5-48: Type of HAZMAT Transportation Events

Hazardous Material Involved	Count
Combustible Liquid	8
Corrosive Material	23
Flammable – Combustible Liquid	42
Miscellaneous Material	1
Nonflammable Compressed Gas	3
Organic Peroxide	1
Oxidizer	1
Poisonous Material	2

5.3.6.C. FEMA DECLARED DISASTERS

There have been no FEMA declared disasters related to hazardous material release.

5.3.6.D. GEOGRAPHIC LOCATION

The entire county is at risk from HAZMAT release. However, the degree of risk varies upon location. Properties adjacent to highways, railroads, and fixed-site facilities and pipelines are at the greatest risk.

5.3.6.E. HAZARD EXTENT

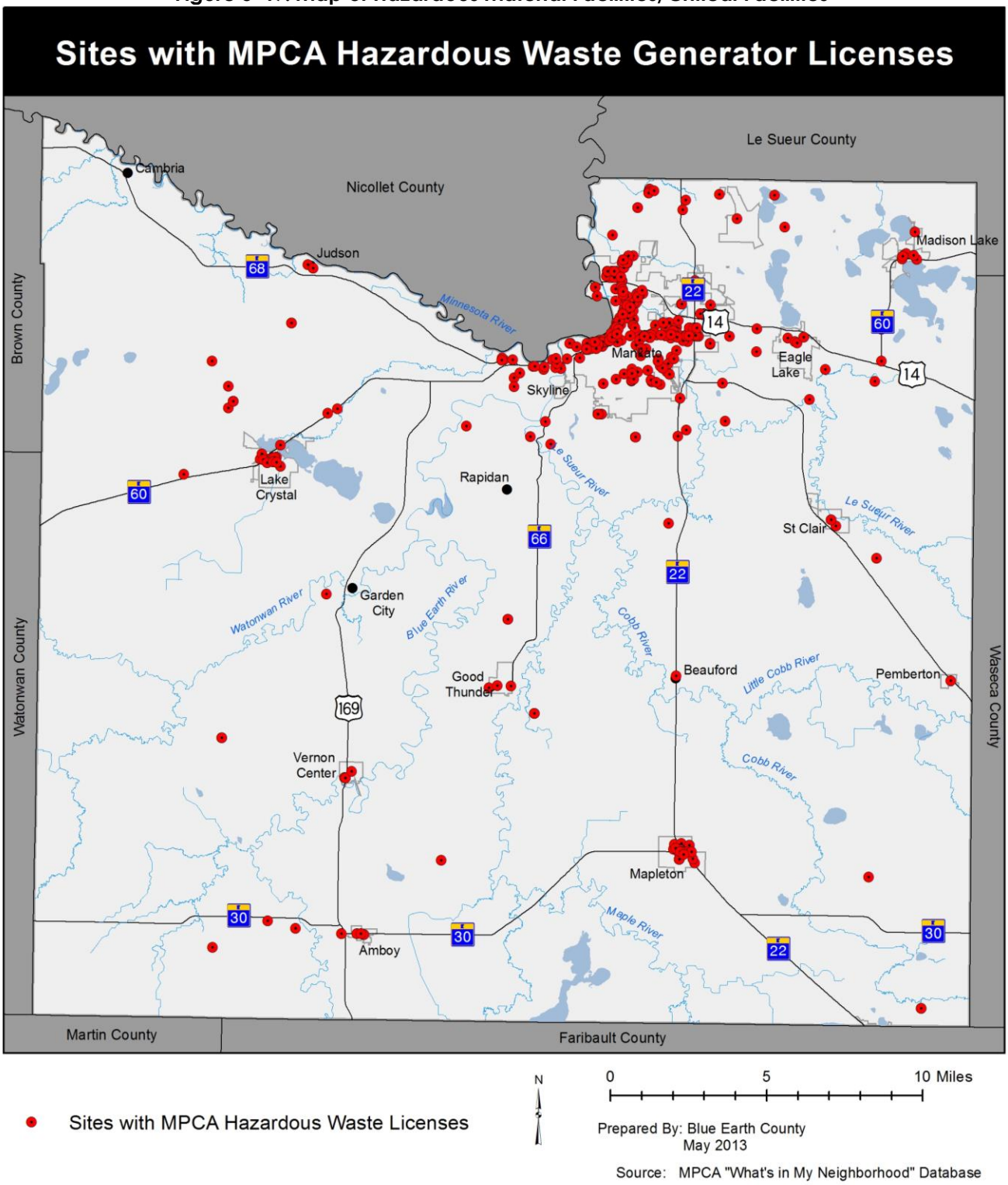
In the event of a hazardous material release, emergency response teams evacuate an area surrounding the site. The hazard extent (or evacuation area) can vary drastically depending on the type of material(s) released, the amount released, the wind direction/speed, and the location of the release. Often emergency response teams use a half mile radius as a starting point for evaluating evacuation needs.

5.3.6.F. VULNERABILITY ANALYSIS

Figure 5-49 shows the spatial distribution of hazardous material sites within the county. With the exception of areas around the city of Mankato (northern part of Blue Earth County), most of these sites are sparsely distributed. This makes areas around Mankato relatively highly vulnerable to hazardous material release than the rest of the cities within the county.

The hazardous material sites comprise of both large and small to minimal quantity generators as classified by the Minnesota Pollution Control Agency (MPCA). This classification helps in providing an estimate of how vulnerable these areas are. For example, as explained in detail on the map (see notes below Figure 5-49), a large hazardous site generator releases 1 kilogram (2.2 pounds) of acutely hazardous material per calendar month. This gives an idea of the quantity of hazardous materials that are released in areas around Mankato (where no less than 15 hazardous material sites are densely distributed).

Figure 5-49: Map of Hazardous Material Facilities/Critical Facilities



Map only includes sites with MPCA hazardous waste licences. A large quantity generator (LQG) is a facility that generates at least 1,000 kilograms (2,200 pounds) of hazardous waste or 1 kilogram (2.2 pounds) of acutely hazardous waste per calendar month. An MPCA permit is not required for a large quantity generator, but the facility must have a current hazardous waste license. This means that they must tell the MPCA what kinds of waste they generate, how much waste they generate, and how they dispose of the waste. (Source: MPCA)

A small to minimal quantity generator is a facility that generates less than 1,000 kilograms (2,200 pounds) of hazardous waste or 1 kilogram (2.2 pounds) of acutely hazardous waste per calendar month. These facilities have less stringent rules than large quantity generators. This group includes Small Quantity Generators (SQGs), which produce 100 - 1000 kg of hazardous waste per month; Very Small Quantity Generators (VSQGs), which produce less than 100 kg of hazardous waste per month; and Conditionally Exempt Generators, which produce less than 100 kg or 10 gallons of hazardous waste per year. Like large quantity generators, SQGs and VSQGs must have current hazardous waste licenses. (Source: MPCA)

5.3.7 SEVERE SUMMER WEATHER

5.3.7.A. HAZARD DEFINITION

Blue Earth County experiences a variety of hazards relating to severe summer weather. These include hail, extreme temperature, lightning, and windstorms.

- ***Hail***

A hailstorm is defined as an outgrowth of severe thunderstorms and develops within a low-pressure front as warm air rises rapidly in to the upper atmosphere and is subsequently cooled leading to the formation of ice crystals. These are bounced about by high velocity updraft winds and accumulate into frozen droplets, falling as precipitation after developing enough weight[72].

- ***Extreme Temperature***

For the purposes of this planning process, the U.S. National Oceanic and Atmospheric Administration (NOAA) definition of extreme temperatures was utilized. The NOAA definition of extreme weather is based on an event's expected occurrence based on climate models. An event is called extreme if it occurs, only five per cent or less of the time.[73] NOAA notes, however, that the exact choice of cut-off of the climatologically probability value used in the definition is somewhat arbitrary. A simple example of extreme weather is therefore when the temperature rises to a level which occurs less than five per cent of the time. This definition was distributed to local jurisdictional stakeholders with risk assessment survey materials as part of the Hazard Mitigation Plan updating process.

- ***Lightning***

Lightning is defined as a luminous manifestation accompanying a sudden electrical discharge, which takes place from or inside a cloud or, less often, from high structures on the ground or from mountains[74].

- ***Windstorm***

Winds in excess of 58 miles per hour (50 knots), excluding tornadoes, are windstorms[75]. Windstorms are often accompanied by thunderstorms. They can also occur as a result of a rapidly approaching cold or warm front.

5.3.7.B. PREVIOUS OCCURRENCES

- ***Hail***

There have been numerous occurrences of hail reported within the county. The first recorded hail event within the county occurred on August 29, 1958. From August 1958 to May 2011 there were 109 reported incidences of hail resulting in zero reported deaths and zero reported injuries. The largest hail storm ever recorded dropped 4.25 inch hail stones and resulted in $250,000 in property damage in Pemberton on June 25, 2010. The second largest recorded event caused $1,000 in damage in Mankato and occurred on June 10, 1994.

There was no crop damage reported according to NCDC data. However that is inaccurate. Crops can be severely damaged based upon the size of the hail and the amount which falls. Hail ranked highly under impact in the township risk assessment (where a high majority of crop damage would occur).

The Blue Earth County NCDC recorded hail events are identified in Figure 5-50.

Figure 5-50: Blue Earth County Hail Events[76]

Start Location	Date	Magnitude	Deaths	Injuries	Property Damage
County	8/29/1958	2.00 in.	0	0	$0
County	6/23/1962	1.50 in.	0	0	$0
County	7/23/1968	1.25 in.	0	0	$0
County	5/28/1974	1.75 in.	0	0	$0
County	5/28/1974	2.75 in.	0	0	$0
County	7/5/1975	1.75 in.	0	0	$0
County	7/15/1978	2.75 in.	0	0	$0
County	5/29/1980	1.75 in.	0	0	$0
County	6/27/1980	1.75 in.	0	0	$0
County	7/14/1981	1.75 in.	0	0	$0
County	7/22/1981	1.75 in.	0	0	$0
County	5/4/1982	1.75 in.	0	0	$0
County	6/30/1983	1.75 in.	0	0	$0
County	4/24/1989	1.00 in.	0	0	$0
County	5/22/1990	1.75 in.	0	0	$0
County	6/19/1991	1.75 in.	0	0	$0
County	6/19/1991	1.75 in.	0	0	$0
Mankato	9/13/1993	1.75 in.	0	0	$0
Mankato	6/10/1994	0.75 in.	0	0	$1,000
Rapidan	8/7/1994	1.75 in.	0	0	$0
County	8/7/1994	1.75 in.	0	0	$0
Mankato	5/17/1996	0.75 in.	0	0	$0
Lake Crystal	6/28/1997	0.75 in.	0	0	$0
Mapleton	6/28/1997	0.88 in.	0	0	$0
Mankato	7/5/1997	0.75 in.	0	0	$0
Mankato	7/18/1997	0.75 in.	0	0	$0
Mankato	7/18/1997	1.75 in.	0	0	$0
Mankato	7/18/1997	1.75 in.	0	0	$0
Beauford	5/15/1998	0.75 in.	0	0	$0
Cambria	5/18/1998	1.75 in.	0	0	$0
Judson	5/18/1998	1.75 in.	0	0	$0
Vernon Center	6/20/1998	0.88 in.	0	0	$0
Mankato	8/9/1999	0.75 in.	0	0	$0
Garden City	5/17/2000	0.75 in.	0	0	$0
Garden City	5/17/2000	0.75 in.	0	0	$0
Mapleton	5/17/2000	1.00 in.	0	0	$0

Start Location	Date	Magnitude	Deaths	Injuries	Property Damage
Cambria	5/17/2000	1.75 in.	0	0	$0
Lake Crystal	5/17/2000	1.75 in.	0	0	$0
Mankato	7/25/2000	0.75 in.	0	0	$0
Amboy	7/25/2000	0.75 in.	0	0	$0
Mankato	7/25/2000	1.50 in.	0	0	$0
Eagle Lake	7/25/2000	1.75 in.	0	0	$0
Amboy	9/2/2000	0.75 in.	0	0	$0
Vernon Center	9/2/2000	1.75 in.	0	0	$0
Mapleton	5/1/2001	0.88 in.	0	0	$0
Garden City	5/1/2001	1.50 in.	0	0	$0
St. Clair	5/1/2001	1.75 in.	0	0	$0
Mapleton	6/1/2001	0.75 in.	0	0	$0
Mankato	4/18/2002	0.75 in.	0	0	$0
Mapleton	4/18/2002	1.75 in.	0	0	$0
Mankato	5/8/2002	1.25 in.	0	0	$0
St. Clair	5/28/2002	0.75 in.	0	0	$0
Cambria	6/3/2002	0.75 in.	0	0	$0
Mankato	5/14/2003	0.88 in.	0	0	$0
Vernon Center	5/14/2003	0.88 in.	0	0	$0
Lake Crystal	5/14/2003	0.88 in.	0	0	$0
Madison Lake	5/14/2003	1.00 in.	0	0	$0
Lake Crystal	5/14/2003	1.00 in.	0	0	$0
St. Clair	6/23/2003	1.00 in.	0	0	$0
Lake Crystal	7/9/2003	1.25 in.	0	0	$0
Cambria	5/9/2004	0.88 in.	0	0	$0
Cambria	5/9/2004	1.00 in.	0	0	$0
Mankato	5/9/2004	1.00 in.	0	0	$0
Eagle Lake	5/9/2004	1.00 in.	0	0	$0
Lake Crystal	5/19/2004	1.00 in.	0	0	$0
Mankato	6/8/2004	1.00 in.	0	0	$0
Pemberton	6/11/2004	0.75 in.	0	0	$0
Mapleton	6/11/2004	1.00 in.	0	0	$0
Mankato	6/7/2005	0.75 in.	0	0	$0
Lake Crystal	6/7/2005	0.88 in.	0	0	$0
Mapleton	6/7/2005	1.00 in.	0	0	$0
Lake Crystal	6/20/2005	0.75 in.	0	0	$0
Good Thunder	6/27/2005	0.75 in.	0	0	$0
Mankato	6/29/2005	0.88 in.	0	0	$0
Mapleton	10/4/2005	0.88 in.	0	0	$0
Mankato	4/18/2006	0.75 in.	0	0	$0
Good Thunder	7/19/2006	1.00 in.	0	0	$0
Good Thunder	7/19/2006	1.75 in.	0	0	$0
Lake Crystal	9/26/2006	0.75 in.	0	0	$0

Start Location	Date	Magnitude	Deaths	Injuries	Property Damage
Eagle Lake	4/30/2007	0.88 in.	0	0	$0
Mapleton	5/19/2007	0.88 in.	0	0	$0
Vernon Center	5/19/2007	0.88 in.	0	0	$0
Good Thunder	6/21/2007	0.88 in.	0	0	$0
Lake Crystal	6/21/2007	0.88 in.	0	0	$0
Lake Crystal	6/21/2007	1.00 in.	0	0	$0
Vernon Center	6/21/2007	1.00 in.	0	0	$0
Lake Crystal	6/21/2007	1.00 in.	0	0	$0
Lake Crystal	6/21/2007	1.00 in.	0	0	$0
Lake Crystal	6/21/2007	1.00 in.	0	0	$0
Amboy	6/21/2007	1.75 in.	0	0	$0
Mapleton	7/3/2007	0.75 in.	0	0	$0
Mankato	7/11/2008	0.75 in.	0	0	$0
Minnesota Lake	7/17/2008	0.75 in.	0	0	$0
St. Clair	7/21/2009	0.75 in.	0	0	$0
Beauford	7/21/2009	1.00 in.	0	0	$0
Beauford	7/21/2009	1.00 in.	0	0	$0
Perth	8/2/2009	1.00 in.	0	0	$0
Mankato	8/25/2009	0.75 in.	0	0	$0
Good Thunder	4/12/2010	0.75 in.	0	0	$0
Garden City	4/12/2010	1.75 in.	0	0	$0
Beauford	4/12/2010	1.75 in.	0	0	$0
St. Clair	4/12/2010	1.75 in.	0	0	$0
Benning	6/1/2010	0.75 in.	0	0	$0
Pemberton	6/17/2010	1.75 in.	0	0	$0
Benning	6/25/2010	1.25 in.	0	0	$0
Pemberton	6/25/2010	4.25 in.	0	0	$250,000
Minneopa	8/13/2010	0.75 in.	0	0	$0
Mapleton	9/15/2010	1.00 in.	0	0	$0
Mankato	5/9/2011	0.75 in.	0	0	$0
Lake Crystal	5/2/2012	0.75 in.	0	0	$0
Mankato	5/2/2012	1.00 in.	0	0	$0
Mankato	5/24/2012	0.88 in.	0	0	$0
TOTAL			**0**	**0**	**$251,000**

- ***Extreme Temperature***

According to the National Climatic Data Center there have been 8 incidences of extreme heat in Blue Earth County since 1994. As Figure 5-51 shows there have been nine heat related deaths and two million dollars in related property damage.

Figure 5-51: Extreme Temperture Statistics 1994-2011

Date	Type	Deaths	Property Damage
7/10/1995	Heat Wave	2	$2,000,000
7/23/1999	Excessive Heat	1	0
7/29/1999	Excessive Heat	0	0
7/30/2001	Excessive Heat	0	0
8/1/2001	Excessive Heat	1	0
8/4/2001	Excessive Heat	5	0
7/30/2006	Heat	0	0
7/18/2011	Excessive Heat	0	0
Total		**9**	**$2,000,000**

- ***Lightning***

The only reported occurrence of a lightning strike that caused significant damage occurred in South Bend Township on September 2nd, 1996 and resulted in $100,000 in property damage. No deaths or injuries were reported[77].

- ***Windstorm***

The NCDC database reported 83 windstorm events since June of 1971. Since then, windstorms have resulted in three injuries and $28,012,000 in property damage. The most violent windstorm ever recorded in the county occurred on May 15, 1998 in Mankato and resulted in twenty million dollars in property damage. The second most violent windstorm occurred in the county on April 7, 2001, resulting in eight million dollars in property damage. The fastest wind speed ever recorded in the county as a result of a windstorm was 76 knots (87.5 miles per hour) on May 4, 1982. There was no crop damage reported according to NCDC data. However that is inaccurate. Crops can be severely damaged based upon the strength of the wind. The recorded windstorm events in Blue Earth County NCDC are identified in Figure 5-52.

Figure 5-52: Blue Earth County Windstorm Events[78]

Start Location	Date	Type	Magnitude	Deaths	Injuries	Property Damage
County	06/24/71	Thunderstorm Winds	68 kts.	0	0	$0
County	06/29/71	Thunderstorm Winds	69 kts.	0	0	$0
County	08/29/73	Thunderstorm Winds	51 kts.	0	0	$0
County	06/18/74	Thunderstorm Winds	52 kts.	0	0	$0
County	06/20/74	Thunderstorm Winds	70 kts.	0	0	$0
County	09/10/75	Thunderstorm Winds	65 kts.	0	0	$0
County	08/19/80	Thunderstorm Winds	52 kts.	0	0	$0
County	04/30/81	Thunderstorm Winds	60 kts.	0	0	$0
County	06/14/81	Thunderstorm Winds	61 kts.	0	0	$0
County	05/04/82	Thunderstorm Winds	76 kts.	0	0	$0
County	06/30/83	Thunderstorm Winds	55 kts.	0	0	$0
County	07/19/83	Thunderstorm Winds	55 kts.	0	0	$0

Start Location	Date	Type	Magnitude	Deaths	Injuries	Property Damage
County	04/27/84	Thunderstorm Winds	56 kts.	0	0	$0
County	07/08/86	Thunderstorm Winds	64 kts.	0	0	$0
County	07/30/86	Thunderstorm Winds	55 kts.	0	0	$0
County	09/03/86	Thunderstorm Winds	60 kts.	0	0	$0
County	06/12/90	Thunderstorm Winds	61 kts.	0	0	$0
County	06/12/90	Thunderstorm Winds	61 kts.	0	0	$0
County	06/12/90	Thunderstorm Winds	57 kts.	0	0	$0
Mankato	06/10/94	Thunderstorm Winds	56 kts.	0	0	$1,000
Mankato	06/30/94	Thunderstorm Winds	65 kts.	0	0	$0
Mankato	07/07/94	Thunderstorm Winds	72 kts.	0	0	$1,000
County	11/18/94	High Wind	52 kts.	0	0	$0
Mapleton	05/19/96	Thunderstorm Winds	60 kts.	0	0	$0
Mankato	06/05/96	Thunderstorm Winds	52 kts.	0	0	$0
Lake Crystal	10/16/96	Thunderstorm Winds	50 kts.	0	0	$0
County	10/29/96	High Wind	64 kts.	0	0	$0
County	04/06/97	High Wind	51 kts.	0	0	$0
Mankato	07/01/97	Thunderstorm Winds	60 kts.	0	0	$0
St. Clair	05/15/98	Thunderstorm Winds	61 kts.	0	0	$0
St. Clair	05/15/98	Thunderstorm Winds	61 kts.	0	0	$0
Mankato	05/15/98	Thunderstorm Winds	61 kts.	0	0	$20,000,000
Mankato	05/15/98	Thunderstorm Winds	61 kts.	0	1	$0
Mankato	06/24/98	Thunderstorm Winds	55 kts.	0	0	$0
Madison Lake	06/25/98	Thunderstorm Winds	55 kts.	0	0	$0
Lake Crystal	07/20/98	Thunderstorm Winds	55 kts.	0	0	$0
Lake Crystal	08/19/98	Thunderstorm Winds	52 kts.	0	0	$0
County	11/10/98	High Wind	60 kts.	0	2	$0
County	03/17/99	High Wind	55 kts.	0	0	$0
Mankato	06/22/99	Thunderstorm Winds	55 kts.	0	0	$0
Lake Crystal	06/26/99	Thunderstorm Winds	55 kts.	0	0	$0
County	04/05/00	High Wind	64 kts.	0	0	$0
Lake Crystal	08/07/00	Thunderstorm Winds	55 kts.	0	0	$0
Mankato	08/07/00	Thunderstorm Winds	50 kts.	0	0	$0
County	04/07/01	High Wind	69 kts.	0	0	$8,000,000
Mapleton	05/01/01	Thunderstorm Winds	55 kts.	0	0	$0
Mankato	05/06/01	Thunderstorm Winds	54 kts.	0	0	$0
Lake Crystal	06/13/01	Thunderstorm Winds	50 kts.	0	0	$2,000
Mankato	06/13/01	Thunderstorm Winds	54 kts.	0	0	$0
Madison Lake	07/23/01	Thunderstorm Winds	50 kts.	0	0	$0
Mankato	08/03/02	Thunderstorm Winds	50 kts.	0	0	$0
Mankato	08/03/02	Thunderstorm Winds	52 kts.	0	0	$0
Mankato	07/04/03	Thunderstorm Winds	52 kts.	0	0	$0
Lake Crystal	07/04/03	Thunderstorm Winds	50 kts.	0	0	$0
Lake Crystal	07/09/03	Thunderstorm Winds	70 kts.	0	0	$0
Garden City	08/21/03	Thunderstorm Winds	55 kts.	0	0	$0

Start Location	Date	Type	Magnitude	Deaths	Injuries	Property Damage
County	04/18/04	High Wind	52 kts.	0	0	$0
Lake Crystal	04/18/04	Thunderstorm Winds	50 kts.	0	0	$0
Good Thunder	04/18/04	Thunderstorm Winds	60 kts.	0	0	$0
Madison Lake	04/18/04	Thunderstorm Winds	52 kts.	0	0	$0
Amboy	07/21/04	Thunderstorm Winds	55 kts.	0	0	$0
Mankato	05/26/05	Thunderstorm Winds	54 kts.	0	0	$0
Lake Crystal	06/08/05	Thunderstorm Winds	55 kts.	0	0	$0
Mankato	06/08/05	Thunderstorm Winds	57 kts.	0	0	$0
Mankato	06/20/05	Thunderstorm Winds	63 kts.	0	0	$0
Lake Crystal	06/20/05	Thunderstorm Winds	52 kts.	0	0	$0
Mapleton	07/25/05	Thunderstorm Winds	52 kts.	0	0	$0
Lake Crystal	08/03/05	Thunderstorm Winds	52 kts.	0	0	$0
Mankato	06/24/06	Thunderstorm Winds	55 kts.	0	0	$0
County	05/06/07	High Wind	59 kts.	0	0	$0
Mankato	07/31/08	Thunderstorm Winds	54 kts.	0	0	$0
Mankato	07/31/08	Thunderstorm Winds	56 kts.	0	0	$0
Mankato	07/31/08	Thunderstorm Winds	58 kts.	0	0	$0
Mankato	06/25/10	Thunderstorm Winds	52 kts.	0	0	$0
Amboy	06/25/10	Thunderstorm Winds	52 kts.	0	0	$0
Mankato	06/26/10	Thunderstorm Winds	56 kts.	0	0	$0
Perth	07/17/10	Thunderstorm Winds	51 kts.	0	0	$0
Amboy	07/17/10	Thunderstorm Winds	52 kts.	0	0	$0
Mankato	07/23/10	Thunderstorm Winds	56 kts.	0	0	$0
Madison Lake	07/23/10	Thunderstorm Winds	52 kts.	0	0	$5,000
Butternut	08/19/10	Thunderstorm Winds	52 kts.	0	0	$0
County	10/26/10	High Wind	50 kts.	0	0	$0
Lake Crystal	07/15/11	Thunderstorm Winds	52 kts.	0	0	$3,000
Garden City	06/10/12	Thunderstorm Winds	52 kts.	0	0	$0
Lake Crystal	06/10/12	Thunderstorm Winds	52 kts.	0	0	$250
Mankato	08/03/2012	Thunderstorm Winds	52 kts.	0	0	$0
TOTAL				**0**	**3**	**$28,012,000**

5.3.7.C. FEMA DECLARED DISASTERS

There have been no federally declared disasters specific to hail, extreme temperature, lightning, or windstorms.

5.3.7.D. GEOGRAPHIC LOCATION

The entire county is at equal risk from hazards related to severe summer weather.

5.3.7.E. HAZARD EXTENT

- ***Hail***

The hazard extent for hail storms varies greatly based off the size, speed, and direction of the storm, and the size of the hail stones. Small hail stones less than one inch in diameter are typical and often cause minimal damage. Significant property damage is most likely to occur when hail stone diameter exceeds one inch. The National Weather Service (NWS) issues Severe Thunderstorm Warnings whenever wind gusts exceed 58 miles per hour and/or hail stones of greater than one inch are detected[79]. Below is the NWS Hail Size Chart used to classify hail stone sizes.

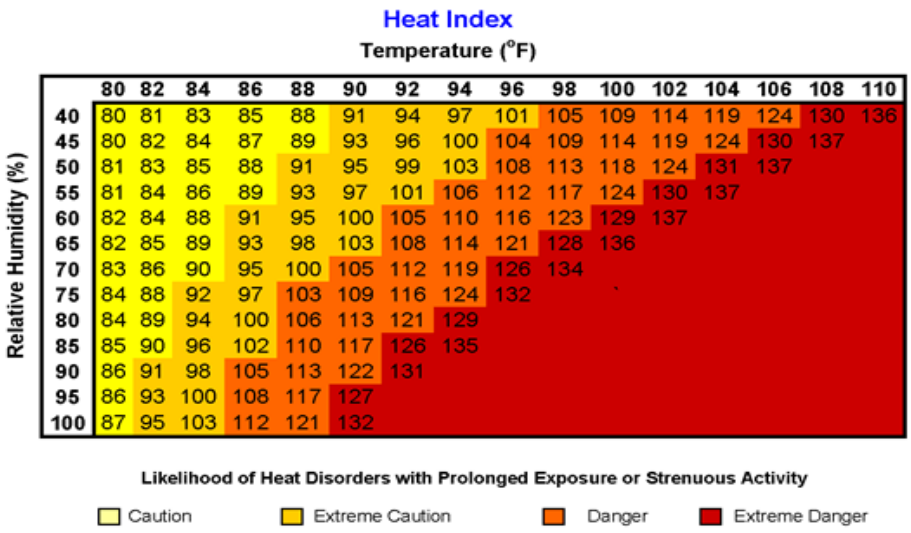
Figure 5-53: Hail Stone Size Chart[80]

Hail Size Diameter	Size Description
0.25"	Pea
0.50""	Mothball
0.75"	Penny
0.875"	Nickel
1.00" (Severe)	Quarter
1.25"	Half-Dollar
1.50"	Walnut / Ping-Pong Ball
1.75"	Golf Ball
2.00"	Hen Egg / Lime
2.50"	Tennis Ball
2.75"	Baseball
3.00"	Teacup / Apple
4.00"	Grapefruit
4.50"	Softball Size
4.75"	CD / DVD

- ***Extreme Temperature***

The extent of the damage that may be caused by extreme temperatures fluctuates depending on the timing, physical location, and magnitude of the event. For extreme heat events, numerous health disorders begin to appear as the temperature rises. Figure 5-54 shows the relationship between these disorders and their associated heat thresholds.

Figure 5-54: Heat Index and Disorder[81]



- ***Lightning***

There are no scales used to measure the extent of Lightning. The extent of the hazard is largely determined by whether or not the lightning strikes a structure, person, or vehicle. If the Lightning does not strike anything, damage is unlikely to occur. However if lightning strikes a building, person, or vehicle, damage is likely to be catastrophic. A lightning strike on an unprotected structure may result in a structure fire that could potentially spread to adjacent structures. Lightning strikes could also result in downed trees and utility poles.

- ***Windstorms***

The extent of windstorms varies greatly based off wind speed and direction. Wind speeds can sometimes exceed 100 miles per hour, resulting in moderate property damage. Windstorms may cause trees to fall on telephone and power lines. Less sturdy structures such as mobile homes may be turned over. Strong winds can overturn high profile vehicles such as semi-trucks and SUVs. Damage to sturdy structures is typically a result of downed trees and utility poles[82]. Windstorms can also compound wildfires and structural fires, causing them to spread more rapidly to adjacent areas. Figure 5-55 describes typical damages from windstorms based off wind speed.

Figure 5-55: Potential Damage from High Winds[83]

Wind Speed (mph)	Potential Damage
30-44	Trees in motion. Light-weight loose objects (e.g., lawn furniture) tossed or toppled.
45-57	Large trees bend; twigs, small limbs break, and a few larger dead or weak branches may break. Old/weak structures (e.g., sheds, barns) may sustain minor damage (roof, doors). Building partially under construction may be damaged. A few loose shingles removed from houses. Carports may be uplifted; minor cosmetic damage to mobile homes and pool lanai cages.
58-74	Large limbs break; shallow rooted trees pushed over. Semi-trucks overturned. More significant damage to old/weak structures. Shingles, awnings removed from houses; damage to chimneys and antennas; mobile homes, carports incur minor structural damage; large billboard signs may be toppled.
75-89	Widespread damage to trees with trees broken/uprooted. Mobile homes may incur more significant structural damage; be pushed off foundations or overturned. Roof may be partially peeled off industrial/commercial/ warehouse buildings. Some minor roof damage to homes. Weak structures (e.g., farm buildings, airplane hangars) may be severely damaged.
90+	Many large trees broken and uprooted. Mobile homes severely damaged; moderate roof damage to homes. Roofs partially peeled off homes and buildings. Moving automobiles pushed off dry roads. Barns, sheds demolished.

5.3.7.F. VULNERABILITY ANALYSIS

- ***Critical Facilities***

All critical facilities in the county are vulnerable to the negative effects of this hazard. However, some facilities will be more susceptible than others. Those buildings without air conditioning will be especially impacted by extreme heat. Taller buildings will be more likely to be damaged by lightening than their shorter neighbors. Finally, buildings with tin roofs or that are pre-fabricated will likely suffer a disproportionate amount of damage from a hail event.

5.3.8 INFRASTRUCTURE FAILURE

5.3.8.A. HAZARD DEFINITION

This is defined as the failure of manmade physical systems, assets, projects, and structures, publicly and/or privately owned, that are used by or provide benefit to the public[84]. Examples of infrastructure include dams, utilities, bridges, levees, drinking water systems, electrical systems, communications systems, sewage systems and roads.

5.3.8.B. PREVIOUS OCCURRENCES

A survey of the Blue Earth County Public Works Department identified the probability of infrastructure failure as medium and the impact as moderate. Some areas of concern identified in the survey include the presence of roads, bridges, and parks in flood plains. Figure 5.56 presents infrastructure failure incidences reported by some cities in Blue Earth County.

Figure 5-56: Infrastructure Failure Incidences

County/City /Township	Infrastructure failure	Date of Occurrence	Injuries	Deaths	Cost of Repair
Pemberton	Overflow of Stormwater manholes	2010	N/A	N/A	$23,212.74
Madison Lake	Water Main Breaks	2013 (January, February and March)	N/A	N/A	$2,500
Blue Earth County	County and township roads, in general, are susceptible to washouts in cases of heavy rainfall/overland flooding, and may also be subject to sinkholes	N/A	N/A	N/A	N/A
Townships - Blue Earth County	Two township bridges have failed inspection recently, primarily due to age, and have been closed.	N/A	N/A	N/A	N/A

5.3.8.C. FEMA DECLARED DISASTERS

There have been no federally declared disasters specific to infrastructure failure in Blue Earth County[85].

5.3.8.D. GEOGRAPHIC LOCATION

Infrastructure failure can occur anywhere where manmade infrastructure resides. Failures are typically isolated to a small area where the physical infrastructure resides.

5.3.8.E. HAZARD EXTENT

Infrastructure failure can have a wide extent based off the type of infrastructure, magnitude of the event, and other conditions such as weather. Certain types of infrastructure failure such as a bridge collapse tend to be isolated events, while others such as dam breaks may trigger other hazards that affect a much larger area than the initial hazard.

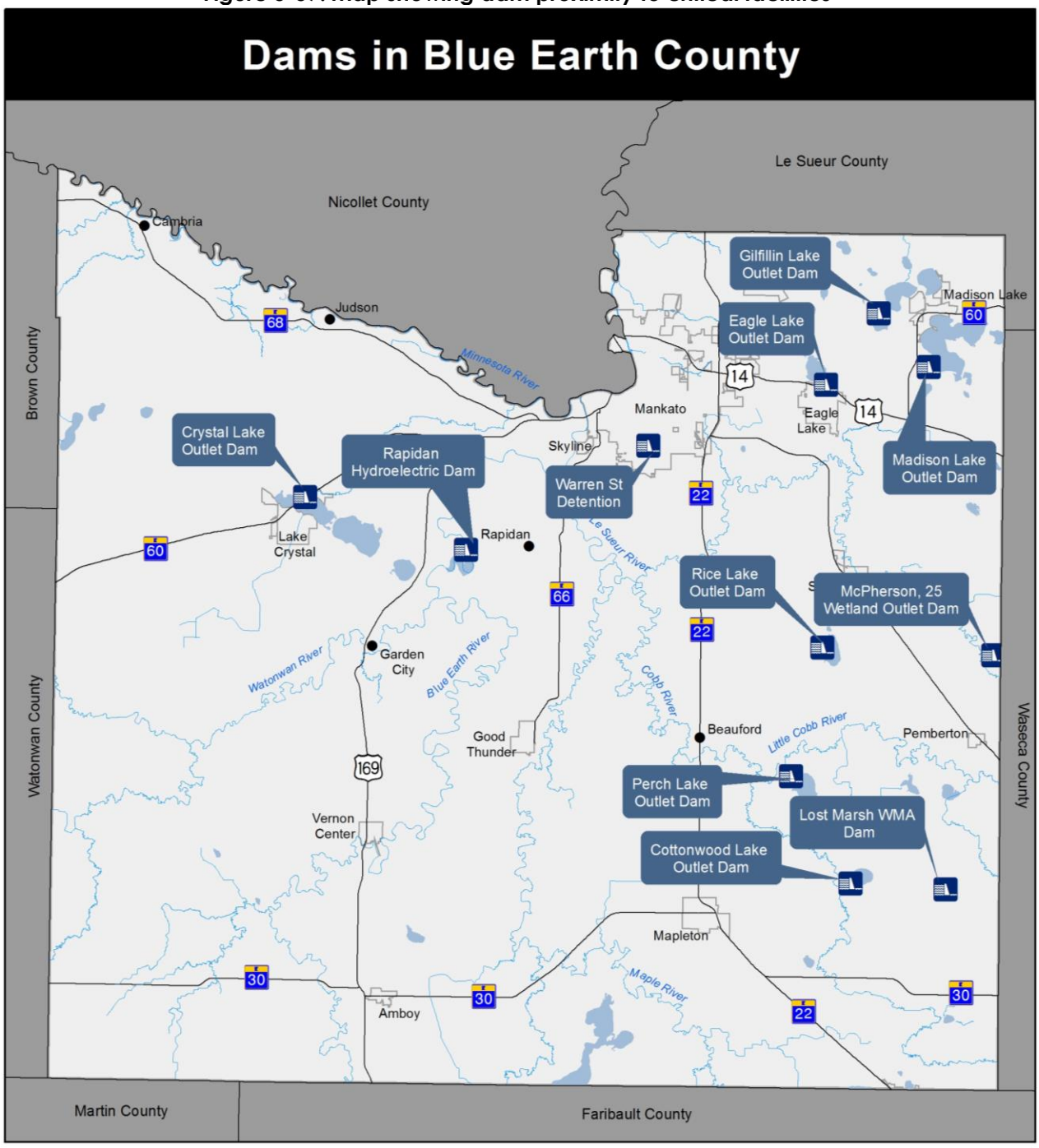
5.3.8.F. VULNERABILITY ANALYSIS

Areas with physical infrastructure or adjacent areas are often at the highest risk from infrastructure failure.

- ***Critical Facilities***

Dams are the only pieces of infrastructure in the county whose failure would bring with it the potential to impact other critical facilities.

Figure 5-57: Map showing dam proximity to critical facilities



5.3.9 TORNADO

5.3.9.A. HAZARD DEFINITION

A tornado is a violently rotating column of air that extends toward the ground from the base of a convective cloud[86]. Strictly speaking, a tornado is a funnel cloud until it reaches the ground. Once a funnel cloud reaches the ground it becomes a tornado. Tornadoes usually form in association with severe thunderstorms, but can also occur as a result of hurricanes or wildfires.

5.3.9.B. PREVIOUS OCCURRENCES

The NCDC database reported 50 tornadoes/funnel clouds in Blue Earth County since July of 1953. Since then, there have been four tornadoes that have caused over one million dollars in damage. Thirteen other tornadoes resulted in property damage of less than one million dollars. The most devastating tornado ever recorded struck the county on June 14, 1976, killing one person, injuring six others, and resulting in $2,500,000 in property damage. The strongest tornado ever recorded in the county, an F4, struck Cambria Township on March 29, 1998. Fortunately there were no reported deaths, injuries, or property damage.

Since record keeping began, there has been one death and nine injuries reported from tornadoes and funnel clouds. There was no crop damage reported according to NCDC data. However that is inaccurate. Crops can be severely damaged based upon the size of the tornado. Tornado ranked highly under impact in the township risk assessment (where a high majority of crop damage would occur).

The Blue Earth County NCDC recorded tornadoes are identified in Figure 5-58.

Figure 5-58: Blue Earth County Tornadoes[87]

Start Location	Date	Type	Magnitude	Deaths	Injuries	Property Damage
County	07/25/53	Tornado	F2	0	1	$250,000
County	05/25/64	Tornado	F0	0	0	$25,000
County	08/02/65	Tornado	F1	0	0	$25,000
County	04/20/68	Tornado	F0	0	0	$0
County	05/24/72	Tornado	F0	0	0	$0
County	06/14/76	Tornado	F2	1	6	$2,500,000
County	05/28/77	Tornado	F1	0	0	$25,000
County	08/18/80	Tornado	F2	0	1	$2,500,000
County	06/14/81	Tornado	F1	0	0	$25,000
County	06/14/81	Tornado	F1	0	0	$2,500,000
County	06/13/83	Tornado	F0	0	0	$25,000
County	07/14/87	Tornado	F0	0	0	$0
County	04/29/91	Tornado	F1	0	0	$25,000
County	04/29/91	Tornado	F1	0	0	$25,000
County	06/22/92	Tornado	F0	0	0	$0
Mankato	05/24/94	Funnel Cloud	N/A	0	0	$0
Mankato	06/30/94	Funnel Cloud	N/A	0	0	$0

Start Location	Date	Type	Magnitude	Deaths	Injuries	Property Damage
St. Clair	06/30/94	Tornado	F1	0	1	$500,000
County	07/07/94	Funnel Cloud	N/A	0	0	$0
St. Clair	07/19/94	Funnel Cloud	N/A	0	0	$0
County	08/07/94	Funnel Cloud	N/A	0	0	$0
Good Thunder	08/07/94	Tornado	F1	0	0	$0
Vernon Center	08/07/94	Tornado	F2	0	0	$50,000
Rapidan	07/23/95	Funnel Cloud	N/A	0	0	$0
Pemberton	07/23/95	Funnel Cloud	N/A	0	0	$0
Rapidan	09/02/96	Funnel Cloud	N/A	0	0	$0
Mankato	07/21/97	Funnel Cloud	N/A	0	0	$0
Cambria	03/29/98	Tornado	F4	0	0	$0
Mapleton	05/01/01	Tornado	F0	0	0	$0
Lake Crystal	05/14/03	Funnel Cloud	N/A	0	0	$0
Lake Crystal	07/09/03	Tornado	F0	0	0	$0
Lake Crystal	07/09/03	Tornado	F0	0	0	$0
Lake Crystal	07/14/03	Tornado	F2	0	0	$100,000
Rapidan	07/14/03	Tornado	F1	0	0	$0
Rapidan	07/14/03	Tornado	F1	0	0	$500,000
Mankato	07/14/03	Tornado	F1	0	0	$100,000
St. Clair	07/14/03	Tornado	F2	0	0	$2,000,000
Pemberton	06/11/04	Funnel Cloud	N/A	0	0	$0
Lake Crystal	06/29/05	Tornado	F0	0	0	$0
Good Thunder	09/02/06	Funnel Cloud	N/A	0	0	$0
Amboy	07/17/08	Tornado	EF0	0	0	$0
St. Clair	06/21/09	Funnel Cloud	N/A	0	0	$0
St. Clair	06/17/10	Tornado	EF0	0	0	$0
Rapidan	06/25/10	Tornado	EF2	0	0	$0
Lake Crystal	06/25/10	Tornado	EF1	0	0	$0
Good Thunder	06/25/10	Tornado	EF2	0	0	$0
Rapidan	06/25/10	Tornado	EF0	0	0	$0
Amboy	07/05/10	Funnel Cloud	N/A	0	0	$0
Rapidan	08/13/10	Funnel Cloud	N/A	0	0	$0
Rapidan	08/13/10	Tornado	EF0	0	0	$0
TOTAL				**1**	**9**	**$11,175,000**

5.3.9.C. FEMA DECLARED DISASTERS

There was one disaster declaration for a tornado in the last decade, on July 2, 2010. There has never been a disaster declaration for a funnel cloud. Figure 5-59 lists all disaster declarations for tornadoes in the county.

Figure 5-59: Disaster Declarations for Tornadoes in Blue Earth County[88]

Type	Declaration Date	Declaration Number	Assistance Type
Flooding, Severe Storm, Tornadoes	6/11/1993	DR-993	Both
Tornadoes and Severe Thunderstorms	4/1/1998	DR-1212	Public
Severe Storms, Straight-Line Winds, Tornadoes	6/23/1998	DR-1225	Public
Severe Storms, Tornadoes, Flooding	7/2/2010	DR-1921	Public

5.3.9.D. GEOGRAPHIC LOCATION

The entire county is at the same level of risk from tornadoes and funnel clouds.

5.3.9.E. HAZARD EXTENT

The extent of the tornado hazard can vary greatly based off the speed and direction the tornado is moving, the speed and diameter of the rotating column of air, and the duration of the storm. Tornados have historically been measured using the Fujita scale, shown in Figure 5-60.

Figure 5-60: Fujita Scale Tornado Rating[89]

Fujita Number	Estimated Wind Speed	Path Width	Path Length	Description of Destruction
0 *Gale*	40-72 mph	6-17 yards	0.3-0.9 miles	Light damage, some damage to chimneys, branches broken, sign boards damaged, shallow-rooted trees blown over.
1 *Moderate*	73-112 mph	18-55 yards	1.0-3.1 miles	Moderate damage, roof surfaces peeled off, mobile homes pushed off foundations, attached garages damaged.
2 *Significant*	113-157 mph	56-175 yards	3.2-9.9 miles	Considerable damage, entire roofs torn from frame houses, mobile homes demolished, boxcars pushed over, large trees snapped or uprooted.
3 *Severe*	158-206 mph	176-566 yards	10-31 miles	Severe damage, walls torn from well-constructed houses, trains overturned, most trees in forests uprooted, heavy cars thrown about.
4 *Devastating*	207-260 mph	0.3-0.9 miles	32-99 miles	Complete damage, well-constructed houses leveled, structures with weak foundations blown off for some distance, large missiles generated.
5 *Incredible*	261-318 mph	1.0-3.1 miles	100-315 miles	Foundations swept clean, automobiles become missiles and thrown for 100 yards or more, steel-reinforced concrete structures badly damaged.

Since 2007, tornadoes have been recorded using the new Enhanced Fujita Scale. The new scale used 8 levels of damage and 28 damage indicators to estimate the 3 second gusting wind speed of the tornado. Wind speeds are estimated based off simulations of various types of damage.

Figure 5-61: Enhanced Fujita Scale Tornado Rating[90]

Fujita Number	3 Second Gusts
EF0	65 – 85 mph
EF1	86 – 110 mph
EF2	111 – 135 mph
EF3	136 – 165 mph
EF4	166 – 200 mph
EF5	200+ mph

5.3.9.F. VULNERABILITY ANALYSIS

Tornadoes can occur within any area in the county; therefore, the entire county population and all buildings are vulnerable to tornadoes. To accommodate this risk, this plan will consider all buildings located within the county as vulnerable. The existing buildings and infrastructure in Blue Earth County are discussed in Section 5.2.

- ***Critical Facilities***

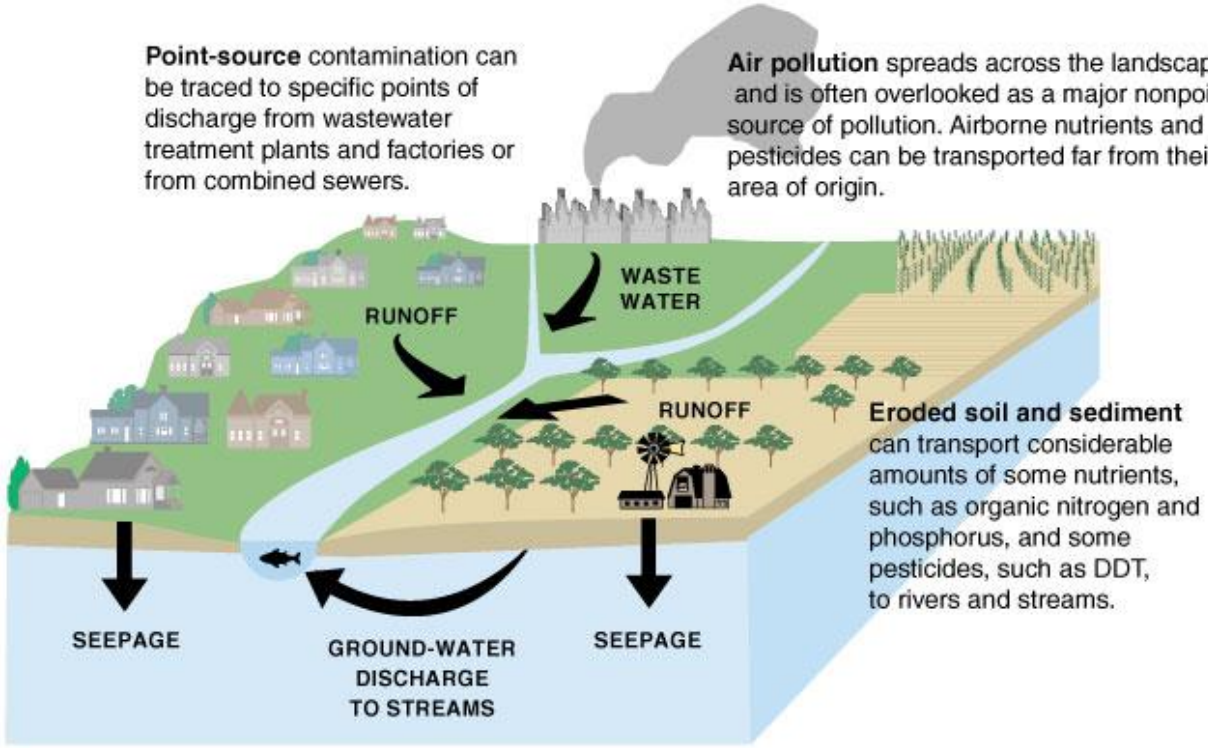
All critical facilities are vulnerable to tornadoes. A critical facility will encounter many of the same impacts as any other building within the jurisdiction. These impacts will vary based on the magnitude of the tornado but can include structural failure, damaging debris (trees or limbs), roofs blown off or windows broken by hail or high winds, and loss of facility functionality (e.g. a damaged police station will no longer be able to serve the community).

5.3.10 WATER SUPPLY CONTAMINATION

5.3.10.A. HAZARD DEFINITION

The presence or addition of any substance to groundwater impacting a community or non-community water system regulated under chapter 4720 which is or may become injurious to the health, safety, or welfare of the general public or private individuals using a well, boring, or groundwater; or which is or may become injurious to domestic, commercial, industrial, agricultural, or other uses which are being made of such water[91].

Figure 5-62: Groundwater Contamination Sources[92]



The Minnesota Pollution Control Agency (MPCA) maintains a database of sites where hazardous materials are used or stored and have the potential to be released into the environment. Many of these industrial and agricultural chemicals are capable of contaminating water supplies if improperly handled.

The main pollutants of concern include suspended solids, nitrate-nitrogen, pathogenic microorganisms and pesticides. The sources of contaminants are diverse. The MDH *City of Mankato Source Water Assessment* identified 348 potential contaminant sources including pipeline, highway, railroad river crossings and parallels; above and below ground petroleum storage tanks; agriculture chemical facilities; animal feedlots; and hazardous waste storage facilities[93].

5.3.10.B. PREVIOUS OCCURRENCES

In 1981 the Minnesota Pollution Control Agency (MPCA) confirmed the presence of contaminants in the groundwater supply of the unincorporated LeHillier area of South Bend Township. The pollutants included nitrates and volatile organic compounds (VOCs). The

area was declared a superfund cleanup site and an advisory was out against drilling new wells or deepening existing ones. Cleanup of the site involved the sealing of wells in the area and construction of a water supply system to service the residents and businesses in the area. In 2007 the MPCA determined that no further action was required on the site, however, the well advisory remains in effect[94].

5.3.10.C. FEMA DECLARED DISASTERS

There have been no federally declared disasters specific to water supply contamination in Blue Earth County[95].

5.3.10.D. GEOGRAPHIC LOCATION

Water supply contamination can occur as a result of either point source pollutants or non-point source pollutants. Point source pollutants are those that can be tracked back to a specific location, such as toxic waste dumped into a river from a manufacturing facility. Non-point source pollutants such as agricultural runoff cannot easily be tracked back to a specific location. The most likely source of possible water supply contamination is often non-point source pollution, such as the runoff of agricultural chemicals from fields into lakes, rivers, and streams.

5.3.10.E. HAZARD EXTENT

The extent of water supply contamination can vary based off the type of pollution entering the water supply, the source type of the pollution (point source vs. non-point source), and the type of water body affected (river, stream, lake, ground water well). Contamination of the groundwater supply is likely to have a more severe impact than surface water contamination.

5.3.10.F. VULNERABILITY ANALYSIS FOR WATER SUPPLY CONTAMINATION

The MN Department of Natural Resources classifies vulnerability to groundwater contamination from surface sources and wells based off the makeup and depth of the layers of rock, till, and soil found above aquifers. Low vulnerability areas are not easily contaminated from surface land uses. Medium vulnerability areas are more susceptible to seepage of surface pollutants into groundwater aquifers. High vulnerability area can be easily contaminated by surface land use activities. It is important to note that all areas can be easily contaminated if surface pollutants are transported below ground via open wells. Land uses in areas of high vulnerability and near open wells should be restricted to activities that will not leech pollutants into the ground.

5.3.11 FLOOD

5.3.11.A. HAZARD DEFINITION

For the purposes of this planning process, the FEMA definition of flooding was utilized as identified in the Minnesota State All-Hazard Mitigation Plan: Flooding is the accumulation of water within a water body (e.g., stream, river, lake, and reservoir) and the overflow of excess water onto adjacent floodplains.[96] This definition was distributed to local jurisdictional stakeholders with risk assessment survey materials as part of the Hazard Mitigation Plan updating process.

According to the Federal Interagency Floodplain Management Task Force, flooding in the United States can be divided into several categories, including: riverine floods, flash floods, alluvial fan floods, ice-jam floods, dam-break floods, local drainage floods, high groundwater floods, fluctuating lake level floods, coastal floods, debris flows, and subsidence.[97] In Minnesota, the most common types of flooding are riverine, flash, and local drainage.[98]

The most common type of flooding event is riverine flooding, also known as overbank flooding. Riverine floodplains range from narrow, confined channels in the steep valleys of mountainous and hilly regions, to wide, flat areas in plains and coastal regions. The amount of water in the floodplain is a function of the size and topography of the contributing watershed, the regional and local climate, and land use characteristics. In steep valleys, flooding is usually rapid and deep, but of short duration, while flooding in flat areas is typically slow, relatively shallow, and may last for long periods of time.
The cause of flooding in large rivers is typically prolonged periods of rainfall from weather systems covering large areas. These systems may saturate the ground and overload the rivers and reservoirs in numerous smaller basins that drain into larger rivers.

Localized weather systems (i.e., thunderstorms), may cause intense rainfall over smaller areas, leading to flooding in smaller rivers and streams. Annual spring floods, due to the melting of snowpack, may affect both large and small rivers and areas.

While there is no sharp distinction between riverine floods, flash floods, ice jam floods, and dam-break floods, these types of floods are widely recognized and may be helpful in considering the range of flood risk and appropriate responses.

Flash flood is a term in wide use by experts and the general population, but there is no single definition or clear means of distinguishing flash floods from other riverine floods. Flash floods involve a rapid rise in water level, high velocity, and large amounts of debris, which can lead to significant damage that includes the tearing out of trees, undermining of buildings and bridges, and scouring new channels. The intensity of flash flooding is a function of the intensity and duration of rainfall, steepness of the watershed, stream gradients, watershed vegetation, natural and artificial flood storage areas, and configuration of the streambed and floodplain. Dam failure and ice jams may also lead to flash flooding. Urban areas are increasingly subject to flash flooding due to the removal of vegetation, covering of ground cover with impermeable surfaces, and construction of drainage systems. Local flash flooding

can be very destructive along the steep bluffs of Lake Superior and the hilly terrain and narrow valleys of southeast Minnesota; however, flash flooding can occur anywhere in Minnesota. Flash flooding occurs on average, three times a year somewhere in the state. Typically, a Flash Flood occurs within six hours of a rain event, or after a dam or levee failure, or following a sudden release of water held by an ice or debris jam, and flash floods can catch people unprepared.[99]

Flooding is usually associated with heavy precipitation during summer storms. However, it can also be caused by unusually heavy snowfall during the winter season, which then melts when spring arrives. Infrastructure failure can also cause flooding – for example a dam or artificial levee failure. Wildfires can increase the speed of flooding by removing ground vegetation that would otherwise have slowed the flow of floodwaters. The danger from flooding can be compounded when floodwaters breach facilities that contain hazardous materials. Once contaminated, the floodwaters can spread the hazardous materials over large areas. Flooding also poses a risk to groundwater by potentially contaminating wells within the flooded area.

5.3.11.B. PREVIOUS OCCURRENCES[100]

The National Climatic Data Center (NCDC) database reported 27 flood events in Blue Earth County since 1996. The NCDC database goes back to the 1950s, however it has no documented flooding occurrences prior to 1996. Blue Earth County has had other flooding occurrences prior to 1996. There was no crop damage reported according to NCDC data. However that is inaccurate. Crops can be severely damaged based upon the severity of the flood.

Figure 5-63: Blue Earth County Previous Occurrences of Flooding

Start Location	Date	Time	Type	Deaths	Injuries	Property Damage
Mankato	6/16/1996	11:00 PM	Flash Flood	0	0	0
Mankato	9/2/1996	5:00 PM	Flash Flood	0	0	0
Countywide	3/15/1997	6:00 AM	Flood	0	0	0
Countywide	4/1/1997	12:00 AM	Flood	0	0	0
Countywide	5/1/1997	12:00 AM	Flood	0	0	0
Countywide	4/1/2001	12:00 PM	Flood	3	1	$200,000,000
Countywide	5/1/2001	12:00 AM	Flood	0	0	0
Countywide	6/9/2004	2:00 AM	Flash Flood	0	0	0
Countywide	6/9/2004	3:15 AM	Flood	0	0	0
Countywide	5/12/2005	9:00 PM	Flood	0	0	0
Countywide	8/18/2005	12:00 AM	Flash Flood	0	0	0
Countywide	10/4/2005	8:00 PM	Flash Flood	0	0	0
Mankato	6/9/2006	11:40 PM	Flash Flood	0	0	0

Start Location	Date	Time	Type	Deaths	Injuries	Property Damage
Mankato	6/16/1996	11:00 PM	Flash Flood	0	0	0
Eagle Lake	6/16/2006	7:48 PM	Flash Flood	0	0	0
Mapleton	5/19/2007	17:40 PM	Flash Flood	0	0	0
Mankato	8/19/2007	12:45 AM	Flash Flood	0	0	0
Beauford	3/15/2010	10:00 AM	Flood	0	0	0
Mapleton	3/15/2010	10:00 AM	Flood	0	0	0
Minnesota Lake	3/15/2010	10:00 AM	Flood	0	0	0
Minnesota Lake	3/15/2010	10:00 AM	Flood	0	0	0
Pemberton	3/15/2010	10:00 AM	Flood	0	0	0
Pemberton	3/17/2010	14:30 PM	Flood	0	0	$400,000
Mankato	6/25/2010	18:30 PM	Flash Flood	0	0	0
South Bend	6/26/2010	20:45 PM	Flash Flood	0	0	0
Minnesota Lake	9/23/2010	12:00 AM	Flash Flood	0	0	0
Amboy	9/23/2010	9:00 AM	Flood	0	0	$2,100,000
Minnesota Lake	3/21/2011	21:00 PM	Flood	0	0	0
TOTAL				**3**	**1**	**$202,500,000**

** NCDC records are estimates of damage compiled by the National Weather Service from various local, state, and federal sources. However, these estimates are often preliminary in nature and may not match the final assessment of economic and property losses related to a given weather event.*

FEMA has documented significant flooding events in Blue Earth County prior to 1996 to the present. These significant flooding events fit into one of two categories.

1.) A Major Disaster (denoted as "DR" under the "Declaration Number" column) can be a result of hurricanes, earthquakes, flood, tornados or major fires; the President then determines supplemental federal aid. The event must be clearly more than state or local governments can handle alone. If declared, funding comes from the President's Disaster Relief Fund, managed by FEMA and disaster aid programs of other participating federal agencies.[101]

2.) An Emergency Declaration (denoted as "EM" under the "Declaration Number" column) is more limited in scope and without the long-term federal recovery programs of a Major Disaster Declaration. Generally, federal assistance and funding are provided to meet a specific emergency need or to help prevent a major disaster from occurring.[102]

5.3.11.C. FEMA DECLARED DISASTERS

The following tables details the FEMA Declared flood disasters that have occurred in Blue Earth County since the 1960's.

Figure 5-64: FEMA Declared Flood Disasters in Blue Earth County

Type	Declaration Date	Declaration Number	Assistance Type
Flooding	4/11/1965	DR-188	Both
Heavy Rains, Flooding	8/15/1968	DR-249	Both
Flooding	4/18/1969	DR-255	Both
Flooding, Severe Storm, Tornadoes	6/11/1993	DR-993	Both
Flooding	6/1/1996	DR-1116	Public
Severe Storms and Flooding	4/8/1997	DR-1175	Both
Flooding	3/19/2010	EM-3310	Public
Flooding	4/19/2010	DR-1900	Public
Severe Storms, Tornadoes, and Flooding	7/2/2010	DR-1921	Public
Severe Storms and Flooding	10/13/2010	DR-1941	Public
Severe Storms and Flooding	5/10/2011	DR-1982	Public

5.3.11.D. HAZARD EXTENT

The extent of flooding depends upon climate (e.g. yearly precipitation levels and likelihood of heavy rainfall events), local land use characteristics, and the size and topography of the contributing watershed.

5.3.11.E. REPETITIVE LOSS PROPERTIES

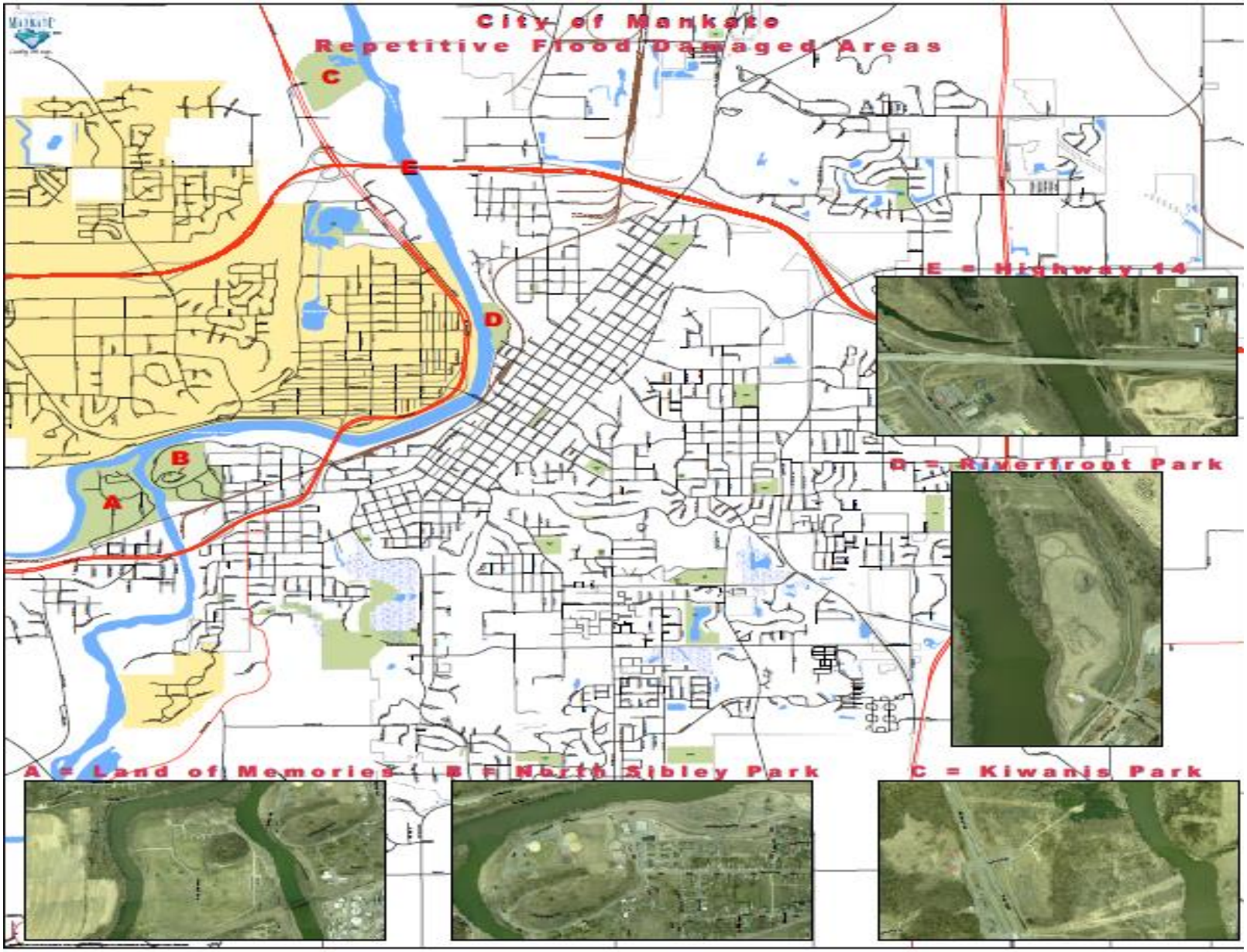
FEMA defines a repetitive loss structure as a structure covered by a contract of flood insurance issued under the NFIP, which has suffered flood loss damage on two occasions during a 10-year period that ends on the date of the second loss, in which the cost to repair the flood damage is 25% of the market value of the structure at the time of each flood loss. According to the Minnesota Department of Natural Resources State Flood Plain Coordinator, there are 2 repetitive loss properties. Information on these properties are available to government officials but are considered confidential to the general public.[103]

According to the National Flood Insurance Program's BureauNet report on policy and loss, as of February 28th, 2013 Blue Earth County had 113 NFIP policies. There have been 50 claims for $553,092.26 on those properties since January 1, 1978. Figure 5-65 lists further detail by community and Figure 5.66 also shows the repetitive flood damaged areas for the city of Mankato.

Figure 5-65: Blue Earth County NFIP

Jurisdiction	Current Policies	Flood Claims	Dollars Paid
Blue Earth County	63	22	$ 285,866.87
Lake Crystal	11	2	$ 5,864.65
Mankato	32	25	$ 203,748.33
St. Clair	7	1	$ 57,612.41
Totals	**113**	**50**	**$553,092.26**

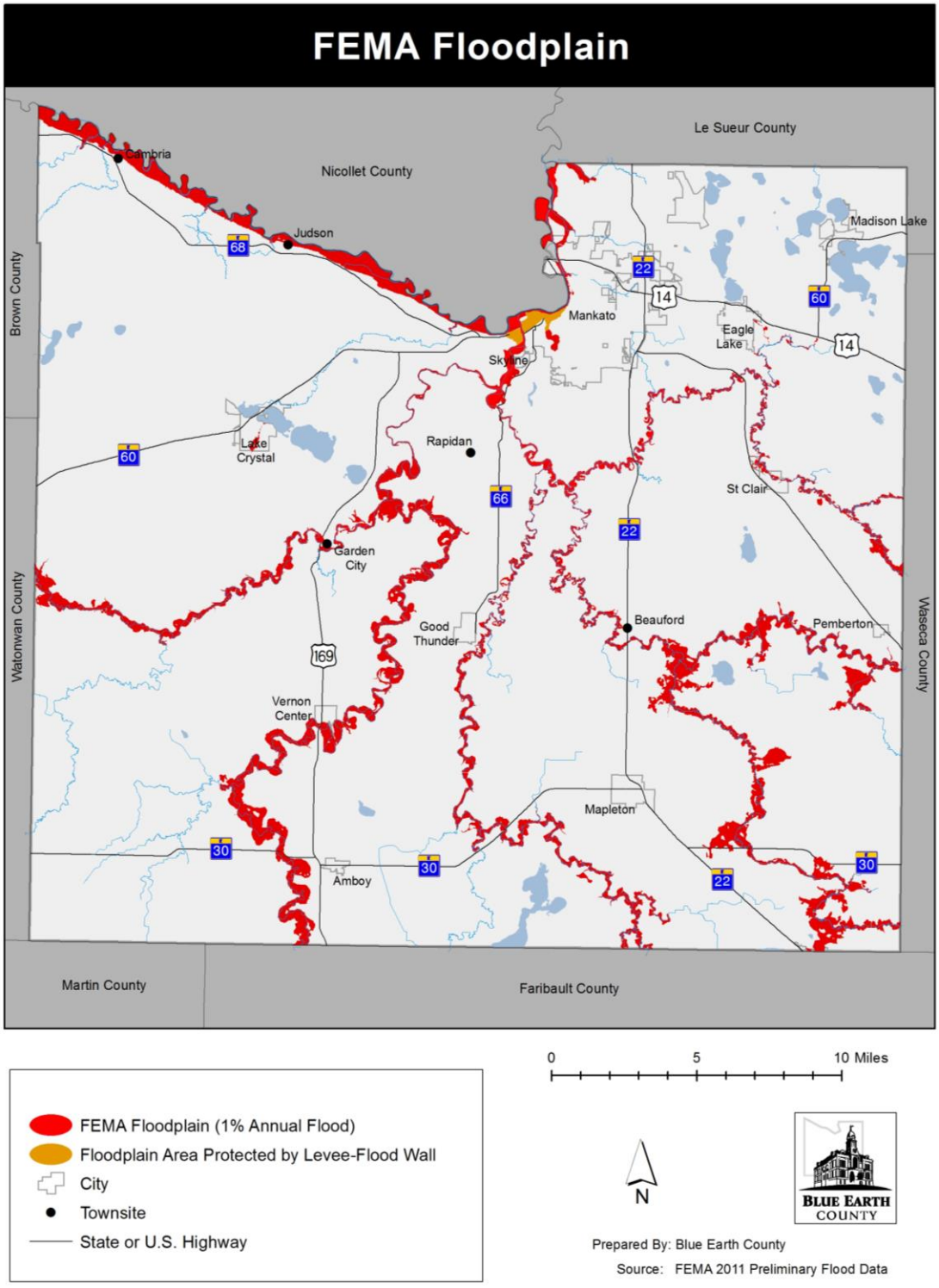
Figure 5-66: Repetitive Flood Damaged Areas (City of Mankato)



5.3.11.F. GEOGRAPHIC LOCATION

The location of flooding activity is dependent on the type of flood. Sudden and extensive rainfall can create standing water in almost any location if drainage is inadequate. For the purposes of this document, Figure 5-67 presents the geographic location of a flood as land within close proximity to existing water bodies.

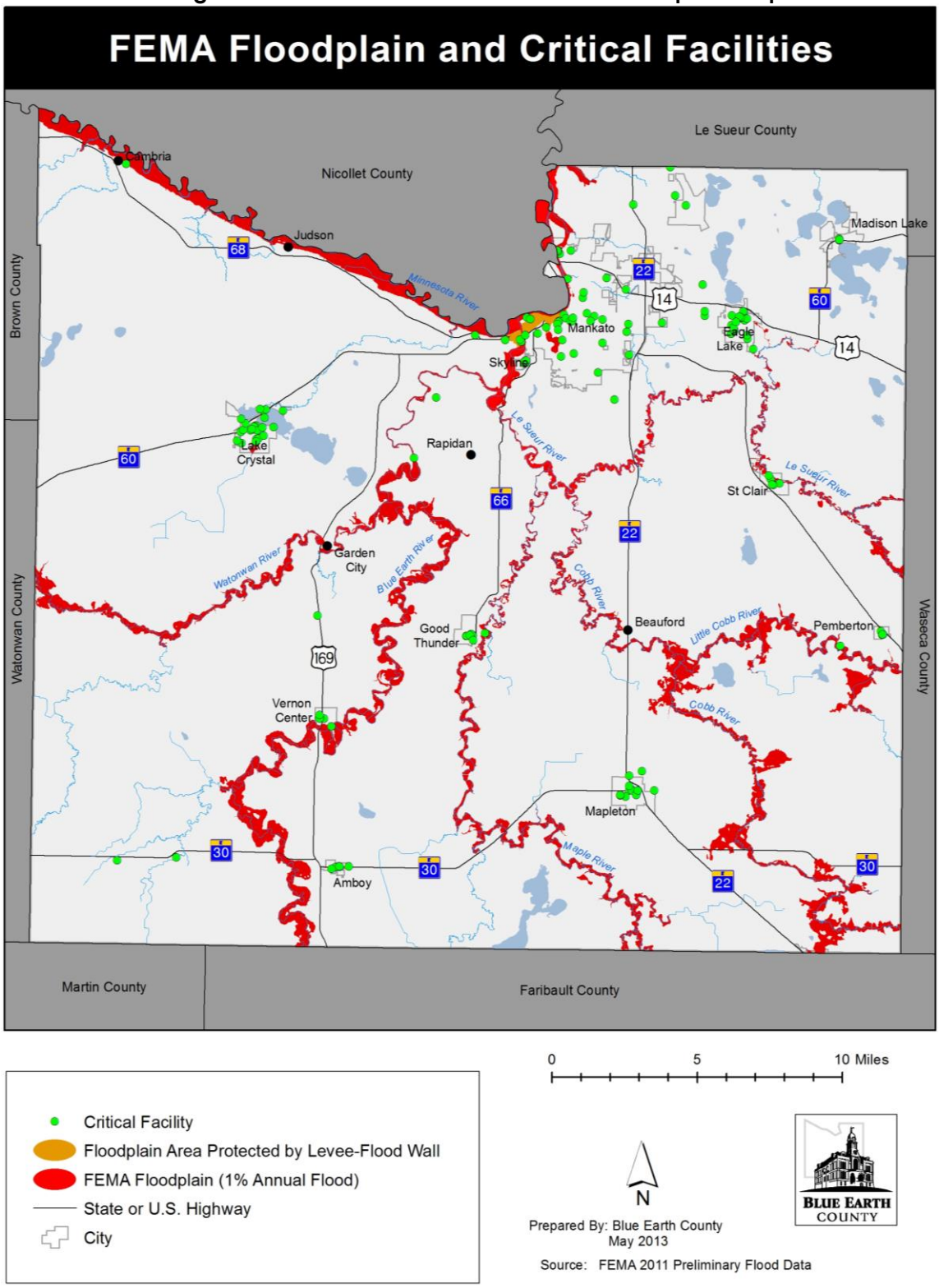
Figure 5-67: Floodplain boundary



5.3.11.G. VULNERABILITY ANALYSIS

When assessing vulnerability it is most practical to look at critical facilities, buildings, and infrastructure within and adjacent to areas of lower elevation. This vulnerability analysis looks at critical facilities, buildings, and infrastructure within the floodplain.

Figure 5-68: Critical facilities overlaid with floodplain map



5.3.12 TERRORISM

5.3.12.A. HAZARD DEFINITION

For the purposes of this planning process, the Federal Bureau of Investigation (FBI) definition of terrorism from the Minnesota State All-Hazard Mitigation Plan was utilized: A terrorist incident is a violent act or an act dangerous to human life, in violation of the criminal laws of the United States, or of any state, to intimidate or coerce a government, the civilian population, or any segment thereof.[104] This definition was distributed to local jurisdictional stakeholders with risk assessment survey materials as part of the Hazard Mitigation Plan updating process.

5.3.12.B. PREVIOUS OCCURRENCES

There are no previous occurances of terrorism within Blue Earth County.

5.3.12.C. GEOGRAPHIC LOCATION

Terrorism is a hazard not tied to a specific geographic location. The previouly given definition of terrorism could refine the geographic location to densly populated areas such as cities.

5.3.12.D. HAZARD EXTENT

Hazards from terrorism can be as a result of:

a. The use of biological, chemical, nuclear and radiological weapons; arson, incendiary, explosive and armed attacks;
b. Industrial sabotage and intentional hazardous materials releases; and
c. cyber terrorism.

In the above identified sources of terrorism, the extent on the county could be in the contamination (chemical, biological, radiological or nuclear), energy (explosive, arson) or failure/denial of services (sabotage, infrastructure breakdown and disruption). It considered eight critical infrastructure categories: telecommunications, electrical power systems, gas and oil facilities, financial institutions, transportation networks, water supply systems, government services and emergency services.

5.3.12.E. VULNERABILITY ANALYSIS

Impacts from terrorism include:

- Damage of pipelines and water supply which will disrupt power generation in and beyond Blue Earth County;
- Disruption in television, radio cell phone systems, and emergency communications systems;
- Loss of lives and/or destruction of properties due to damage of buildings in high dense population areas; and

- Loss of lives and/or severe impact on the health of people due to the release of chemicals to the air and water.

The County's vulnerability to terrorism is considered high in areas with high population density -mostly areas which attract crowd – as well those critical facilities which serve most people –including telecommunications, electrical power systems, gas and oil facilities, financial institutions, transportation networks, water supply systems, government services and emergency services.

- ***Critical Facilities***

All critical facilities listed in Section 5.2 are vulnerable to terrorist attack due to the large number of people these facilities serve in the county. Section 5.2.1.D lists High Potential Loss facilities found within the county. These represent the greatest risk of a terrorist attack due either to a high concentration of people or being essential to the administration of the county.

5.3.13 ANIMAL AND CROP DISEASE

5.3.13.A. HAZARD DEFINITION

For the purposes of this planning process, the following definition from the Minnesota Department of Agriculture was used to define animal and crop disease: "The detection of pest(s) or disease(s) that exceed the normal level of official concern."[105] This definition was distributed to local jurisdictional stakeholders with risk assessment survey materials as part of the Hazard Mitigation Plan updating process.

5.3.13.B. PREVIOUS OCCURRENCES

The Minnesota All-Hazard Mitigation Plan lists a number of occurrences in state history of animal disease.

Figure 5-69: Infectious Disease of Livestock and Poultry in Minnesota

Date	Cause	Location	Impact	Containment Method
1800s to 1930	Glanders in horses	Statewide	Disease of respiratory tract and skin. Can be fatal or cause chronic disease in horses which limits horses ability to perform. Transmissible to people.	-Elimination of public watering troughs -Test and euthanize positive animals
1894-1972	Hog cholera in swine	Statewide	Fatal viral disease of swine. Animals die of disease and can't be used as food.	-Swine movement restrictions -vaccination - federal (USDA) / state eradication program
1880s – 1976 Recurred 2005 in NW MN	Tuberculosis in cattle	Statewide	Chronic disease of cattle that is transmissible to people. Cause for condemnation of animal as food at slaughter	-test and slaughter test positives - federal (USDA)/ state eradication program
1800s - 1984	Brucellosis in cattle and swine	Statewide	Chronic disease of cattle and swine that is transmissible to people. Causes abortions in animals	-test and slaughter -vaccination -federal (USDA) / state eradication program
1920s - 1975	Pullorum Disease in poultry	Statewide	A bacterial disease caused by one type of salmonella Causes death especially in young chickens and turkeys	-testing and improved sanitary measures in flocks -test and remove -national poultry improvement plan to classify farms according to disease presence

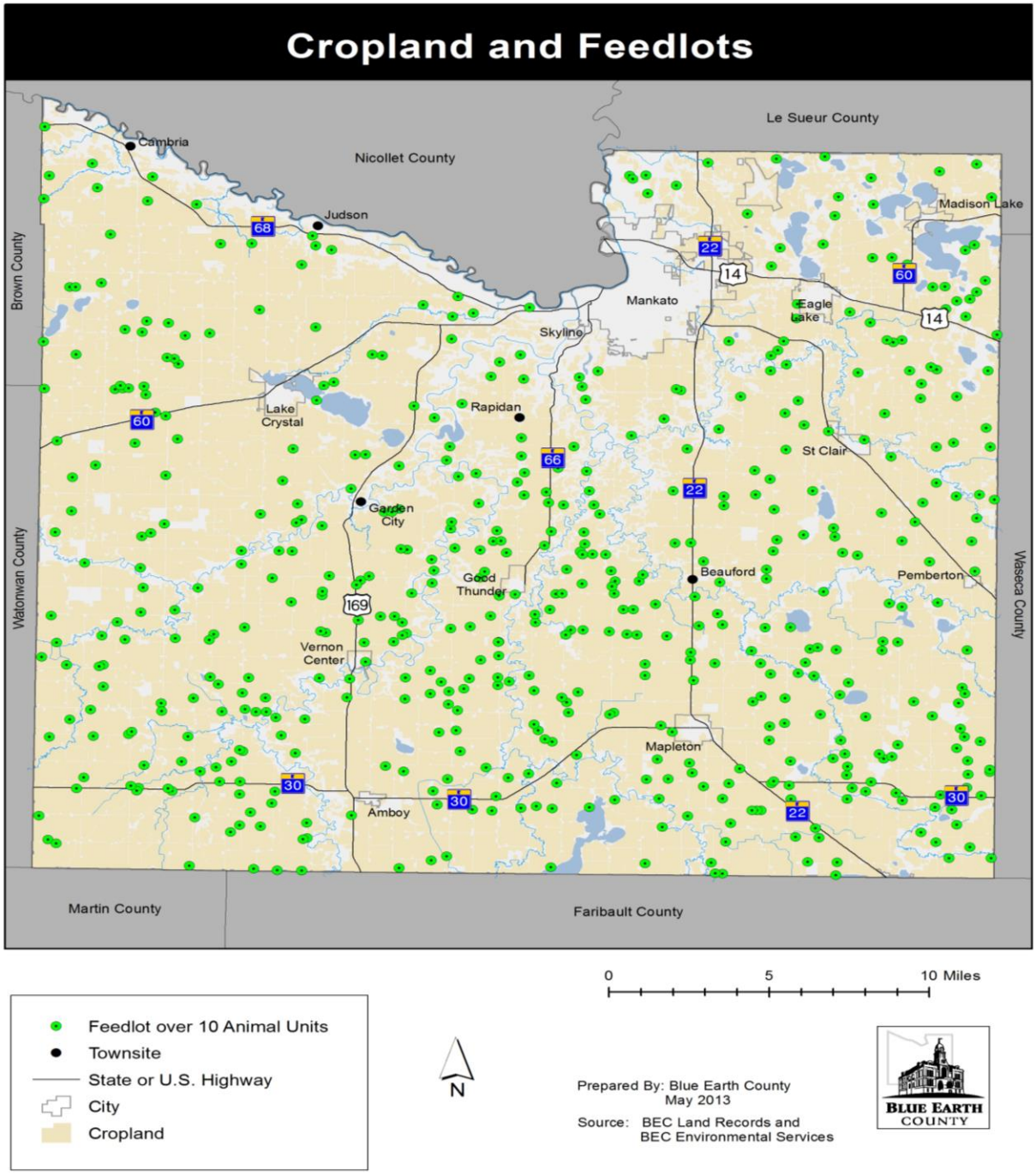
As Figure 5-69 shows, none of these diseases are impacting the state or Blue Earth County in a major way at the present time. The largest animal disease currently impacting the County is Porcine Reproductive and Respiratory Syndrome (PRRS). Most of the swine stock in Blue Earth County is infected by this ailment which causes reproductive failure in female pigs and respiratory illness in young pigs. However, this is not a unique situation for the County, as PRRS affects the majority of swine in the nation.[106]

The Minnesota Department of Agriculture lists several potentially damaging crop diseases on their website, including Potato Cyst Nematodes, Soybean Rust, and Ralstonia solanacearum. However, none of these diseases have been identified in impacting Minnesotan crops at the present time.

5.3.13.C. GEOGRAPHIC LOCATION

An animal or crop disease outbreak can occur anywhere within Blue Earth County where there are crops or livestock. The map below show the areas of agricultural land within the County as well as the major feedlots.

Figure 5-70: Map of feedlots and agricultural land



5.3.13.D. HAZARD EXTENT

The hazard extent varies depending on the overall health of the impacted animals or crops, the specific characteristics of the disease, and the ability of county and state officials to mount a response.

5.3.13.E. VULNERABILITY ANALYSIS

The risk animal and crop disease poses to critical facilities is related to how it can impact response times and recovery from other hazard events. Given the nature of the hazard it does not pose a significant risk on its own. The largest potential risk from this particular hazard is to the economic wellbeing of the county, rather than the health and welfare of its citizens.

5.3.14 SINKHOLES AND LAND SUBSIDENCE

5.3.14.A. HAZARD DEFINITION

For the purposes of this planning process, the FEMA definition of sinkholes and land subsidence were utilized as identified in the Minnesota State All-Hazard Mitigation Plan: "There are three types of potential problems associated with the existence or formation of sinkholes: subsidence, flooding, and pollution. The term subsidence commonly involves a gradual sinking, but it also refers to an instantaneous or catastrophic collapse. Karst landforms are the primary natural causes of land subsidence in Minnesota."[107]

This definition was distributed to local jurisdictional stakeholders with risk assessment survey materials as part of the Hazard Mitigation Plan updating process.

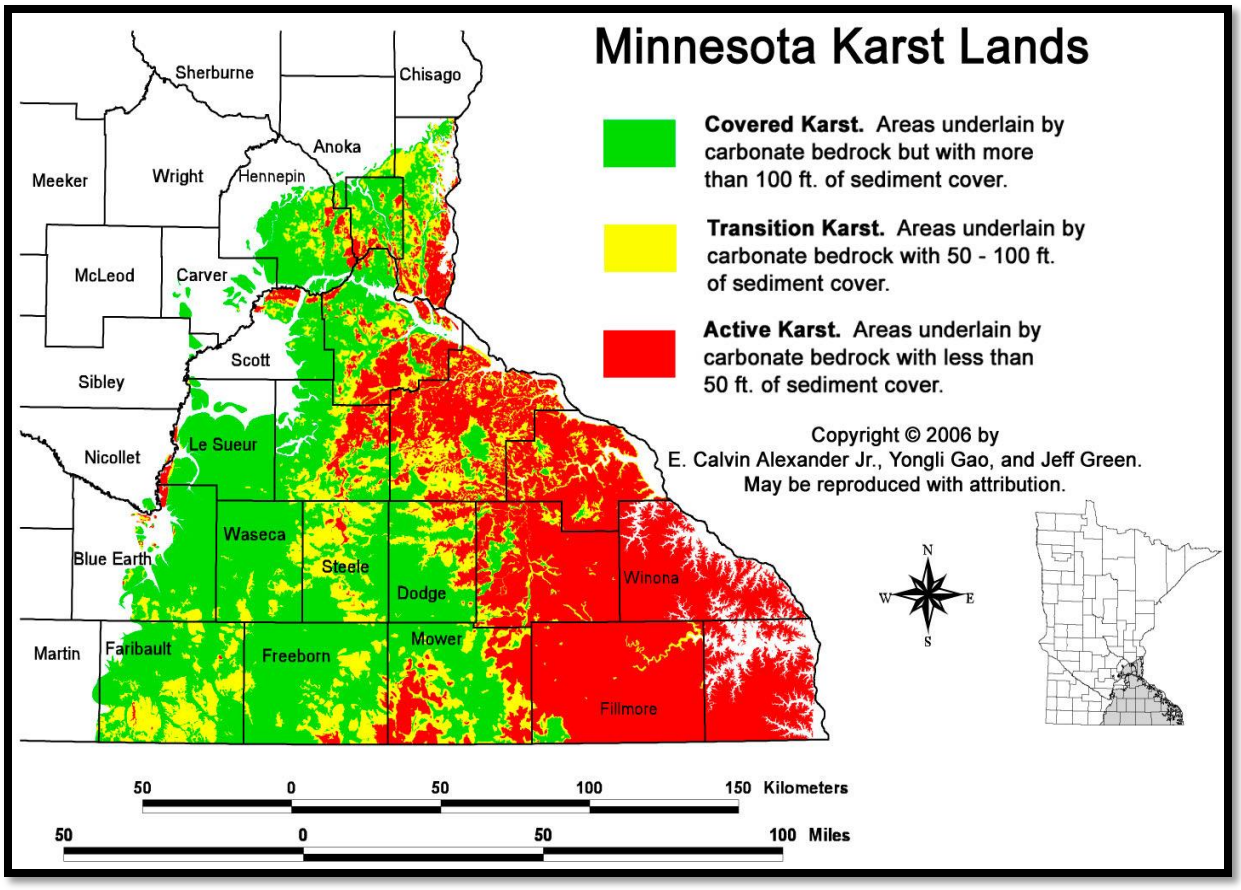
5.3.14.B. PREVIOUS OCCURRENCES

There are no significant sinkhole or subsidence related disaster events on record for Blue Earth County.

5.3.14.C. GEOGRAPHIC LOCATION

Blue Earth county has a very small area of Active Karst land along its north-central border with Nicollet County. Additionally, most of the eastern portion of the county is classified as Covered Karst, with a portion being Transition Karst. See Figure 5-71 for details.

Figure 5-71: Map of karst formations



5.3.14.D. HAZARD EXTENT

The hazard extent varies depending on the presence of infrastructure and buildings, severity of groundwater flooding, and extent of pollution.

5.3.14.E. VULNERABILITY ANALYSIS

The County's susceptibility to the hazards of sinkholes and land subsidence can be considered to be negligible.

5.3.15 INVASIVE SPECIES

5.3.15.A. HAZARD DEFINITION

For the purposes of this planning process, the Minnesota Department of Natural Resources (DNR) definition was utilized: When nonnative species (Species that have been introduced, or moved, by human activities to a location where they do not naturally occur) cause ecological or economic problems.[108] This definition was distributed to local jurisdictional stakeholders with risk assessment survey materials as part of the Hazard Mitigation Plan updating process.

5.3.15.B. PREVIOUS OCCURRENCES

The Minnesota DNR monitors invasive species at the state level and has capacity to track several species at the county level. The presence of an invasive species is predominately monitored by periodic checks by DNR staff or reporting by residents. The DNR currently identifies the prescence of two invasive species within Blue Earth County. Eurasian Water Milfoil and Curly Pondweed are found in the lakes within the County.

Figure 5-72: MN DNR Invasive Plant Species within Blue Earth County (June 2012)[109]

Family Name	MN DNR Official Name	Common name
Haloragaceae	Myriophyllum Spicatum	Eurasian Water Milfoil
Potamogetonaceae	Potamogeton Crispus	Curly Pondweed

Both of these aquatic plants present a threat to the many lakes found in Blue Earth County. Eurasian watermilfoil is especially problematic, since it has the ability to reproduce through stem fragmentation. It only takes one stem fragment trapped in a boat rudder or similar transport to start a new colony in a previously free lake. If allowed to overpopulate these plants can pose a risk to existing lake ecosystems.

In addition to aquatic invasive species, there are other organisms that pose a threat if introduced to the ecosystem of Blue Earth County. One of the largest of these is Dutch Elm disease. Dutch Elm disease was recorded in Minnesota as early as 1961. By 1982, the disease had been found in 84 of Minnesota's 87 counties.[110] The first documented case of Dutch Elm disease in Blue Earth County was 1967.[111] The tree losses due to the diesase were significant across southern Minnesota (including Blue Earth County). A possible reason is due to the European elm bark beetle being commonly found throughout the southern third of the state. In northern Minnesota the native elm bark beetle is the primary vector. As the elms were lost in southern Minnesota the incidence of the disease subsided. By contrast, northern Minnesota has faced increasing losses of Elms.[112]

Between the Minnesota DNR and the Minnesota Department of Agriculture the following invasive species are confirmed to not exist currently within Blue Earth County. These species are being called out because of their current prevalence in other portions of the state.

Figure 5-73: Prevalent Animal Invasive Species within Minnesota

Type of Invasive Species	Present in Blue Earth County
Emerald Ash Borer	No[113]
Gypsy Moth	No[114]
Zebra Mussel	No[115]
Spiny Water Flea	No[116]

5.3.15.C. GEOGRAPHIC LOCATION

An invasive species could impact all areas of Blue Earth County. Per the earlier stated definition, it is most likely to occur in locations of human activities. Depending on the invasive species, once they are introduced into a new geography there are multiple methods of spreading in the environment.

5.3.15.D. HAZARD EXTENT

The hazard extent for an invasive species would involve the entire ecosystem of a particular geography. Ecological problems from an invasive species would impact other species and have ripple effects throughout the ecosystem. The extent would depend on the invasive species.

5.3.15.E. VULNERABILITY ANALYSIS

The Minnesota DNR and the Minnesota Department of Agriculture have reports analyzing some economic impact of a few invasive species. There is no data specific to Blue Earth County. The impact of invasive species to critical facilities and the building inventory is minimal. There is potential for an invasive species to impact infrastructure within Blue Earth County, however, that impact is negligible for the invasive species that are currently present within the County. The impact on infrastructure would depend on the type of invasive species.

5.3.16 NEAR-CHANNEL EROSION - RIVERINE AND RAVINE EROSION AND LANDSLIDES

5.3.16.A. HAZARD DEFINITION AND DESCRIPTION

Erosion associated with river systems in the county is a growing problem affecting dwellings, infrastructure, cropland, and water quality. What is unique to hazard mitigation planning in the county is that riverine related erosion is occurring near the channel from bluffs and ravines largely outside of the FEMA floodplain, as well as from streambanks. Because river systems in the county are unique and contributing significant and disproportionately high amounts of sediment to the Minnesota River as result of this erosion, geologic and water quality scientists are studying these systems. A consultant involved with studying riverine erosion in Blue Earth County assisted with this risk assessment. The consultant's report, *Special Hazard Mitigation Risk Assessment of Near Channel Riverine Erosion Hazards in Blue Earth County - Streambanks, Bluffs, and Ravines*, is attached to this report (see Appendix 8.1) . It is important to note that there is much more to learn about near channel erosion in Blue Earth County as it relates to hazard mitigation as well as water quality.

Definitions

To describe erosion hazards, a number of definitions are needed to profile this hazard in Blue Earth County.

Erosion hazard - As stated in the 1999 *FEMA Riverine Erosion Hazard Mapping Feasibility Study*, erosion hazard area is defined by Section 577 of National Flood Insurance Reform Act (NIFRA):

"Erosion hazard area means, based on erosion rate information and other historic data available, an area of erosion or avulsion is likely to result in damage or loss of property or infrastructure within a 60 year period."

For Blue Earth County hazard mitigation planning purposes, this definition needs further refinement and targeting to specific areas where erosion hazards exist, including ravines and bluff erosion and landslides all occurring within and associated with river channels in Blue Earth County. These features can be grouped and termed "near channel erosion."

Stream banks are the portions of the river or stream channel which restrict lateral movement of water. Stream bank erosion is a natural process, but acceleration of this natural process leads to land loss, stream channel instability, increased sediment, habitat loss and other adverse effects. (EPA Stream Channel Erosion EPA, WARSSS, Channel Processes: Streambank Erosion http://water.epa.gov/scitech/datait/tools/warsss/ streamero.cfm)

Bluffs are tall steep features distinguished from streambanks based on height. Bluffs are defined as features with greater than 10 feet of relief in 20 foot by 30 foot area. The vertical nature of bluffs makes them susceptible to sudden and catastrophic failure. (Day, 2013)

During periods of moderate and high flow, bluffs are eroded by the river in deeply incised channels lacking a floodplain. Bluffs also fail due to landslides and mass wasting. The river removes the soils deposited by mass wasting and landslides. As a result the eroded, nearly vertical slope cannot stabilize and reestablish itself with vegetation.

Landslides - Mass Wasting - The USGS definition of landslides includes a wide range of ground movement, such as rock falls, deep failure of slopes, and shallow debris flows. Although gravity acting on an over-steepened slope is the primary reason for a landslide, there are other contributing factors:

- erosion by rivers create oversteepened slopes
- rock and soil slopes are weakened through saturation by snowmelt or heavy rains
- excess weight from accumulation of rain or snow, or from man-made structures may stress weak slopes to failure and other structures

Slope material that become saturated with water may develop a debris flow or mud flow. The resulting slurry of rock and mud may pick up trees, houses, and cars, thus blocking bridges and tributaries causing flooding along its path.

The EPA defines mass wasting as:

"The erosional processes associated with mass wasting include two primary types:

- shallow, fast movements of debris avalanche/debris torrents and mudflows that generally move only once, and
- slow, deep-seated slump/earthflow erosional processes that move intermittently over varying time scales in response to infrequent events and/or disturbance factors.

Erosion associated with mass wasting processes is extremely difficult to predict due to the episodic nature of climatic events that initiate movement. Often landslides occur many years following vegetation and land use changes due to complex interactions of root mass decay and soil saturation from major storms." (EPA, Hillslope Processes: Mass Wasting http://water.epa.gov/scitech/datait/tools/warsss/wasting.cfm)

Ravines

Ravines are large ephemeral gullies and intermittent streams with a channel and banks. (EPA Channel Processes: Gully Erosion) Ravines grow primarily by headward erosion at the far upstream end, and like rivers the banks and bluffs within the ravines can also erode and fail. (Day 2013)

Streambank Erosion/Channel Enlargement

Bank erosion takes place by two processes, channel migration and channel widening. Channel migration occurs in all rivers and contributes to bank and bluff erosion along the full extent of the rivers in Blue Earth County. (Day, 2013)

Enlargement of channels can be caused by combined processes of incision, bank erosion and direct modification by construction activities. Lateral erosion may occur in stable streams, but the point bar follows at the same rate, thus the stream does not get wider over time. This contrasts with enlargement, where the width of the stream gets wider over time due to lateral erosion, often concurrently on both banks. The results of enlargement are increased erosion from stream bed and banks, increased deposition due to decreased shear stress and stream power, loss of habitat, increased water temperatures, and a shift in

evolutionary state of morphological stream types. Increased flows due to watershed changes, storm drains from urban runoff, power generation due to "ramping flows" from reservoir releases and contraction scour below culverts and bridges can all contribute to channel enlargement. Combined processes of incision, degradation, aggradation, and lateral accretion can be associated with enlargement. (EPA, Channel Processes: Channel Enlargement http://water.epa.gov/scitech/datait/tools/warsss/enlarge.cfm)

Summary of *Special Hazard Mitigation Risk Assessment of Near Channel Riverine Erosion Hazards In Blue Earth County - Streambanks, Bluffs, And Ravines*

River systems in Blue Earth County are within deeply incised channels not seen in other areas of Minnesota. The geology and geologic history of this area combined with modern land use, creates rivers highly susceptible to significant bluff failures, bank erosion, and ravine growth.

The rivers in the county are not well evolved. The incision process within the river channels started as a result of a catastrophic drainage of the Glacial River Warren (current Minnesota River valley) causing incision through glacial till and bedrock to form the Minnesota River valley, 230 feet deep at Mankato. The base level of the Blue Earth River channel and its tributaries in Blue Earth County continue to incise to reach equilibrium with the Minnesota River at the base of the watershed.

Base level drops in the channel create knickpoints. Knickpoints are channel slope discontinuities. The higher channel slope formed downstream of knickpoints leads to increased channel erosion at this location. As a result, the over-steepened section moves upstream. Knickpoints in the Blue Earth River and its tributaries are approximately 22-37 miles upstream of the Minnesota River and continue to move upstream. Fully evolved channels lack knickpoints and have well developed floodplains. The Blue Earth watershed and its tributaries are still actively eroding to a rapid and significant base level.

This natural, ongoing incision creates steep valley walls, bluffs and ravines. More importantly as incision progresses more bluffs are created and ravines deepen. Evolved channels have wider floodplains where they rarely interact with bluffs, yet that is not the case in Blue Earth County. Rivers in Blue Earth County are incising through thick glacial tills soils deposited in the last glacier. These soils are moderately erodible, but strong enough to form near vertical bluffs. The near vertical nature of these features makes them sudden and catastrophic failure.

Bluff erosion can occur through many different mechanisms. In the Blue Earth basin the primary mechanisms identified are over-steepening at the base of the bluff, freeze-thaw, and groundwater sapping. While each of these processes occurs naturally both over-steepening and groundwater sapping can be heavily influenced by human activity in the watershed. Freeze-thaw occurs in the spring and fall as water in bluffs freezes and expands then thaws and contracts. This process weakens the bluff making it seasonally more susceptible to failure. Groundwater sapping occurs where groundwater flows out through the face of a bluff. As the groundwater flows out it saturates and weakens the bluff sediment. The saturated sediment may be slowly eroded away as water flows over the bluff surface or may weaken the sediment to a degree where it is at greater risk of significant

failure. Groundwater sapping can be intensified by lawn irrigation or due to septic fields placed such that water flows toward the river. Over-steepening at the base of the bluff is likely the most important process and takes place at every bluff connected to the river. Over-steepening occurs as the erosive power of the river removes material from the base of the bluff leading to increased slope. As the slope reaches a critical slope, which is dependent on many variables including the sediment type, moisture content, vegetation and others, it fails. The size of these failures is dependent in part on how over-steepened the bluff becomes before failure occurs. The rate of over-steepening is determined by the flow volume and velocity in the river. Changes to hydrology can lead to greater rates of over-steepening and therefore greater rates of erosion or failure.

Natural and human caused changes in hydrology play a critical role in the failure of stream banks, bluffs and ravines, as more water is entering ravines and rivers. Land use changes have increased runoff to rivers from urban and agricultural land uses while infiltration and evapotranspiration has been reduced. Vegetation changes, such as conversion of native prairie, pastures and wetlands to row crops and removing trees and vegetated buffers, reduce soil stability, reduce evapotranspiration and increase runoff. Drainage of surface and subsurface soils for crop production alter hydrology by increasing runoff. Climate and changing summer storm intensity also results in increased runoff and higher flows which worsening near channel erosion.

5.3.16.B. PREVIOUS OCCURRENCES

There is no recorded data base of near channel erosion. Data for this plan was constructed largely from the recollections of local sources, verified with local public data and aerial photographs to the extent practicable. Dwellings and infrastructure known to be relocated or impacted by riverine erosion or landslides are listed in Figure 1.

Figure 1: Previous Occurrences

River and Watershed	Township/ City	Description	Date(s)	Cost	Source
Blue Earth Watershed					
Blue Earth	City of Mankato	Riverine erosion caused by flooding, Land of Memories Park, city well field	2010		City of Mankato
Blue Earth		Bluff erosion, Dwelling moved or demolished	unknown	unknown	Aerial photos
Blue Earth	South Bend	Ongoing ravine erosion, rip rap on township roads			Township survey
Blue Earth		• Ravine erosion, debris flow • Erosion control structure damaged	2010		Benco Power
Blue Earth River	Shelby	Section 27, Township Road, Channel migration	??	??	Survey
Le Sueur Watershed					
Le Sueur	Decoria	Channel migration, Dwelling relocated	1960s	Unknown, private project	Local source (HW)

River and Watershed	Township/ City	Description	Date(s)	Cost	Source
Le Sueur	Decoria	• West of CSAH 16, Bluff erosion/landslide, • Dwelling relocated	1990s	Unknown, private project	Local source (P&Z)
Le Sueur	Decoria	West of CSAH 16, Bluff erosion/landslide, bluff toe stabilization	2011	Private project, Unknown	Local sources
Le Sueur	Mankato	• River Hills Lane • Bluff erosion, Landslide	1980s	Unknown	Army Corps of Engineers project
Le Sueur	Mankato	• River Hills Lane • Bluff erosion, Landslide, • Wood Toe Slope Protection	2011	Unknown	SWCD
Le Sueur	Mankato	• River Hills Lane • Bluff erosion, Landslide	2012	Private data	USDA NRCS
Le Sueur	City of St. Clair	• Bluff erosion, • Bank stabilization	1990s	unknown	Local sources
Maple	Decoria	• River Heights, • Bluff erosion, Landslide, Dwelling damaged	1981	unknown	Local sources
Maple	Decoria	• River Heights, • Bluff erosion, Landslide, • Dwelling relocated			
Maple	Rapidan	Ivy Road, Channel erosion/migration, Bridge impacted	2010	???	Local sources
Maple	Lyra	Bluff erosion, Township Road relocated twice	unknown	unknown	Local sources
Watonwan Watershed					
Watonwan	Garden City	Bluff erosion, Dwelling moved and demolished	???	???	DNR/BEC
Middle Minnesota Watershed					
Morgan Creek	Judson	Bank erosion, Township road, streambank rip-rap	2010		Township survey
Minnesota River	City of Mankato	Bank erosion, Land of Memories Park well field, bank stabilization	2012		Local sources
Unnamed Ravines	City of Mankato	• Lake Street, • Lime Valley Road			Local sources

(USDA-funded project data is private information under federal law.)

5.3.16.C. GEOGRAPHIC LOCATION

Near channel erosion is occurring along every river in the county. While near channel erosion as a result of channel incision and widening is occurring along all rivers in the county, the most problematic hazard areas currently are in the lower reaches of the rivers where the river channels are most deeply incised and where there is the greatest population density.

Bluff and ravine locations were identified by the consultant in the *Special Hazard Mitigation Risk Assessment of Near Channel Riverine Erosion Hazards in Blue Earth County - Streambanks, Bluffs, and Ravines*. Figure 2 displays the location of near channel bluff erosion. Figure 3 displays the location of near channel ravine erosion.

Compared to most other parts of the Minnesota where there is "low incidence" of landslides, Blue Earth County has a "moderate susceptibility" to landslides in the Blue Earth, Le Sueur and Minnesota River watersheds (see Attachment 1 on page 132 for USGS Map - Landslide Overview Map of the Conterminous United States). The 1982 digital compilation of the *USGS Landslide Incidence and Susceptibility Map for the United States*, showing the areas of moderate landslide susceptibility in and around Blue Earth County is attached to this report. Susceptibility to landsliding was defined as the probable degree of response of the areal rocks and soils to natural or artificial cutting or loading of slopes or to anomalously high precipitation. The map is generalized and limited by the availability of data available. (USGS, Landslide Overview Map of the Conterminous United States http://landslides.usgs.gov/learning/nationalmap/)

Jurisdictions with infrastructure or dwellings within potential hazard area

With 338 miles of rivers and streams in Blue Earth County, only three of 23 townships are unaffected by near channel erosion: Lincoln, Butternut Valley, and Jamestown. Of the eleven municipalities in the county, five are located near or have facilities near a river. Mankato and St. Clair and Vernon Center are located near a river. Wastewater treatment facilities for Pemberton and Good Thunder are located away from the main city limits near the river channel.

Figure 4. Jurisdictions within potential hazard area

Municipalities

Good Thunder
Mankato
Pemberton
St. Clair
Vernon Center

Townships

Beauford Township
Cambria Township
Ceresco Township
Danville Township
Decoria Township
Garden City Township
Judson Township
LeRay Township
Lime Township
Lyra Township
McPherson Township
Mankato Township
Mapleton Township
Medo Township
Pleasant Mound
Rapidan Township
Shelby Township
South Bend Township
Sterling Township
Vernon Center Township

Figure 2. Location of Bluffs

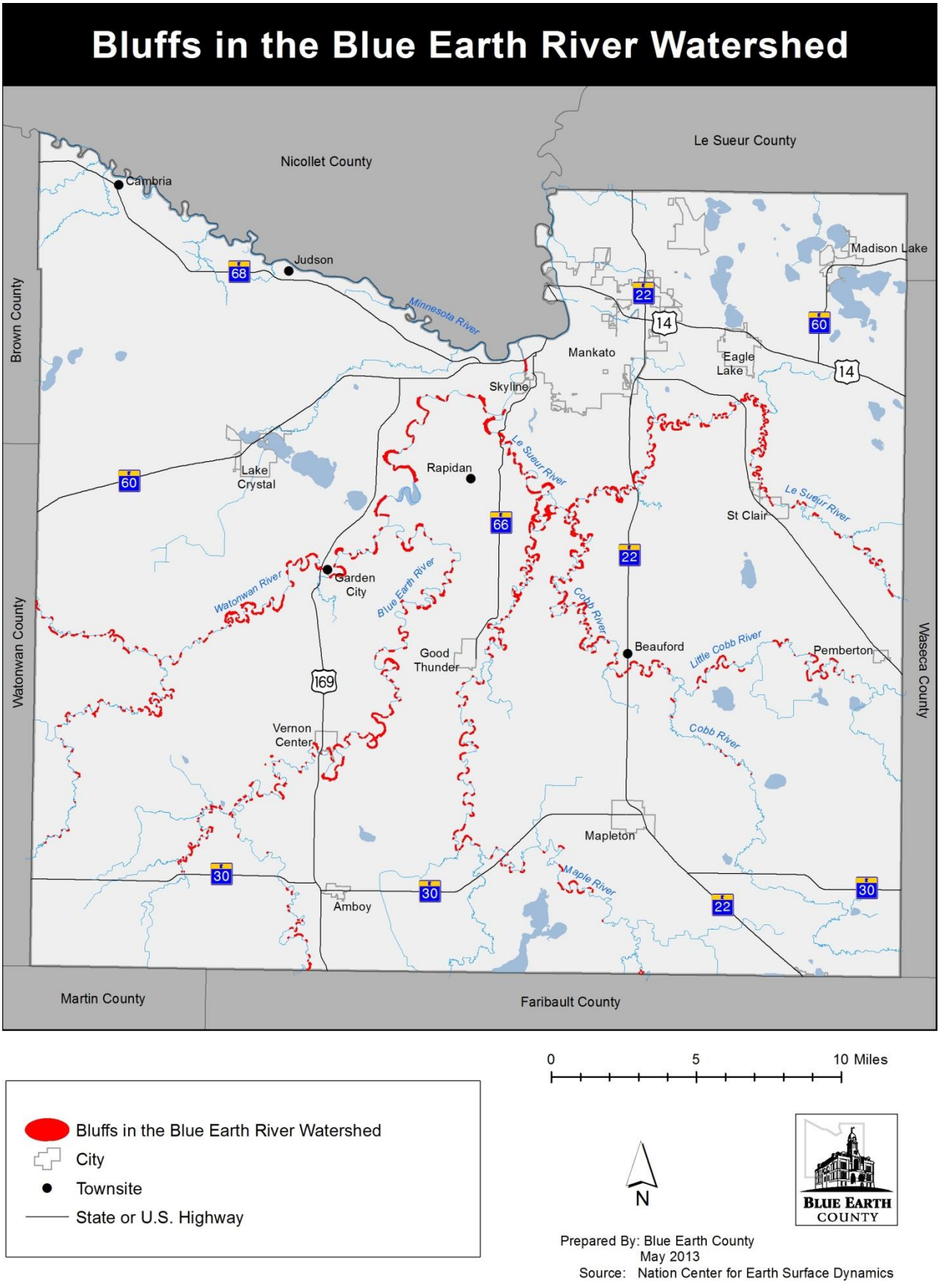
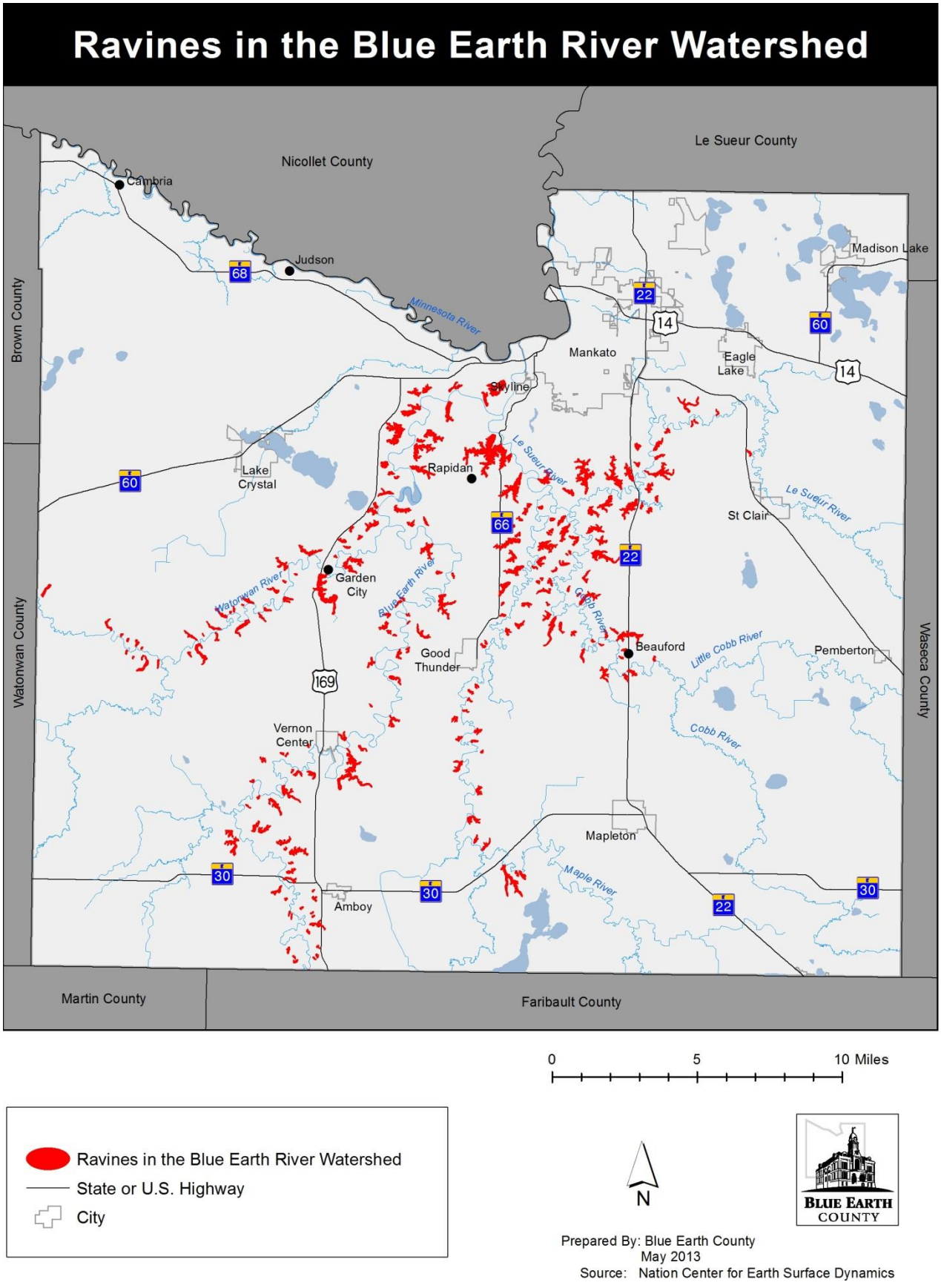


Figure 3. Location of Ravines



5.3.16.D. HAZARD EXTENT

Due to the episodic nature of climatic events that initiate many instances of near channel erosion, reliable models or other methods to *predict* near channel erosion presently do not exist. This is particularly true in Blue Earth County where multiple forms of near channel erosion are taking place, and the processes, interaction and extent of each is not fully understood at this time. Near channel erosion, especially landslides, often occurs many years following land use changes, vegetation changes and major storms due to the complex interaction of soil saturation and impacts to root structure, mass and decay. (EPA, Hillslope Erosional Processes: Mass Wasting http://water.epa.gov/scitech/datait/tools/warsss/wasting.cfm)

Erosion Rate Analysis

Erosion rates were analyzed in the Special Hazard Mitigation Risk Assessment of Near Channel Riverine Erosion Hazards in Blue Earth County - Streambanks, Bluffs, and Ravines. Aerial photos were used to analyze bluffs, ravines and stream bank erosion. The following are descriptions of the erosion rates of each type of near channel erosion.

Bluffs- Erosion rates were estimated from aerial photograph analysis terrestrial laser scanning (TLS). Aerial photographs provide the average decadal retreat rate for 332 of the more than 900 bluffs throughout Blue Earth County. TLS provides annual bluff erosion rates on 15 bluffs on the Le Sueur, Maple, Big Cobb and Little Cobb Rivers. Rates of bluff erosion measured from aerial photographs range from 0 to 3 feet a year with an average retreat rate of 0.56 feet per year, and the average rates of the TLS ranging from 0 to 1 foot per year with an average of 0.66 feet per year. (Day 2013)

Ravines- There are 295 near channel ravines identified in the Blue Earth River watershed and its tributaries. Ravine growth has been measured on 64 ravines connected to the Le Sueur and Maple Rivers. Of the 64 ravines on these rivers, only four had grown more than 33 feet in 67 years. The rates of ravine growth are poorly documented, and no study has determined what factors cause some bluffs to grow faster than others.

Stream banks- Migration rates of over 1.6 feet per year have been recorded on rivers in Blue Earth County. Generally channel migration does not result in a net loss of sediment because all sediment lost is deposited along another bank downstream, yet there remains a hazard associated with channel migration and bank erosion. Channel widening occurs when the deposition that traditionally occurs during channel migration is absent. In the Blue Earth basin channel widening is occurring in response to changing hydrology. Channel widening rates range from 0.09 – 0.69 feet per year. Erosion resulting from channel widening can also be a hazard for infrastructure near the channel.

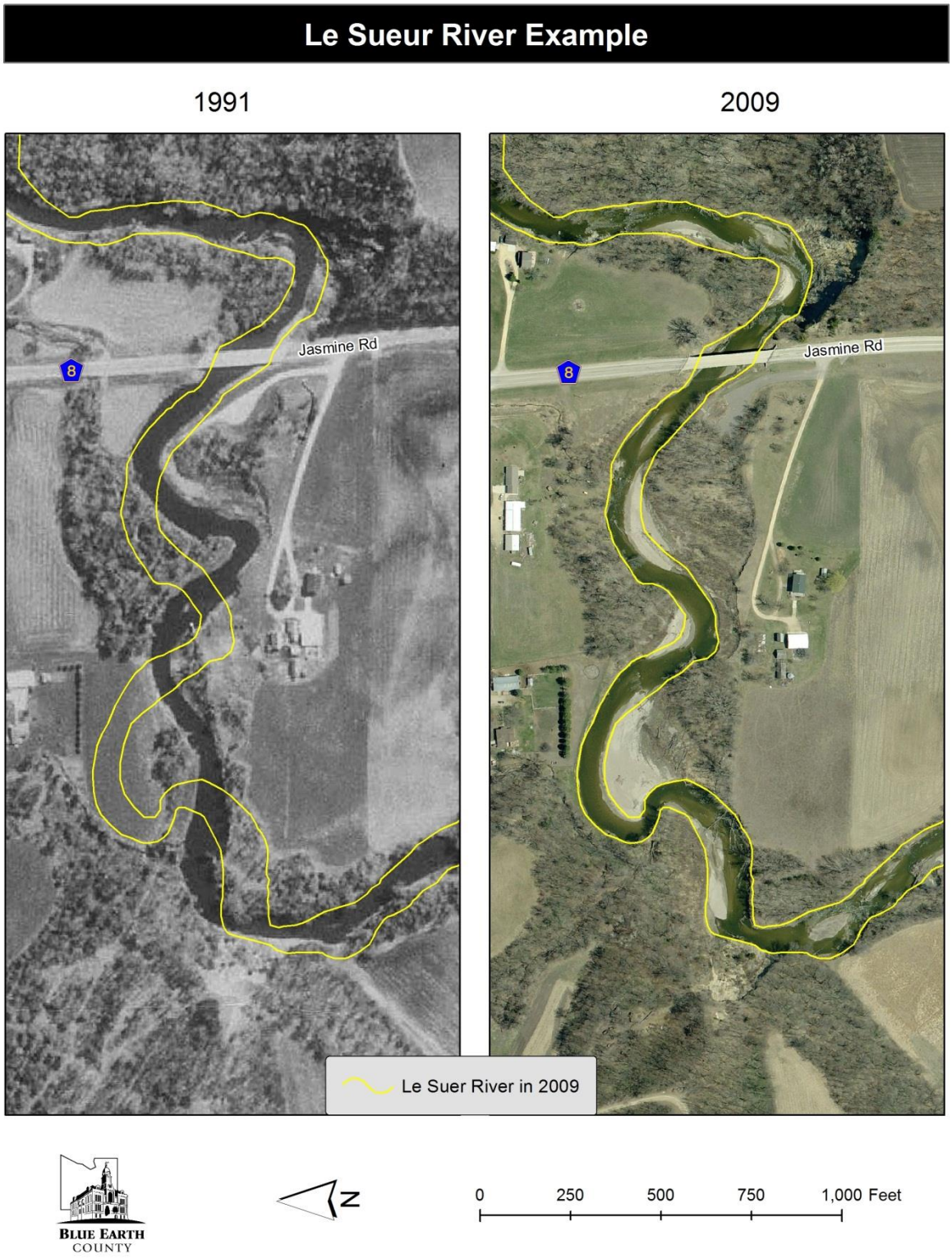
Figure 5 shows the result of channel and knickpoint migration during a single event on the Maple River in 2010. This single storm event eroded a new channel on an outside curve creating a lost channel (oxbow). Figure 6 shows the area before and after the storm and restoration. Figure 7 shows channel migration and near channel erosion on the Le Sueur River over a period of 18 years.

Figure 5. Maple River Ivy Road Bridge during high flow September 2010 (looking downstream)

Source: Blue Earth County Public Works, 2013

Figure 6: Maple River – Ivy Road, Rapidan Township. Before and after September 2010 event and restoration.

Figure 7. Le Sueur River Channel Migration, Decoria Township



Data Gaps and Needs

The average rates of erosion are a good start for planning purposes, but more information is needed because the rate of near channel erosion is not occurring at a steady pace of inches or feet per year consistently or in all locations. Local observations and aerial photo analysis of problem areas show that near channel erosion is episodic with the effects sometimes occurring years after storm events. How well the landscape and streams accommodate natural events is influenced by modifications of surface and internal drainage by vegetative changes and road systems, conversion from woody to grass/forb riparian communities, direct alterations to stream channels such as channelization, abandonment of floodplains, confinement of river systems, and a large list of other land use changes.

Until there is a better understanding of near channel erosion in Blue Earth County's unique setting, any predictive assessment of these erosional processes should be done on a site specific basis and must rely primarily on an experienced individual who can recognize the relative stability/instability of an area from soil and geology maps, aerial photographs, vegetation indicators and field observations. This type of analysis was not in the budget or scope of the hazard mitigation planning process.

Erosion rate of bluffs and banks lining ravines remains unstudied. Like bluffs and banks on the river mainstem, bluffs and banks within ravines may be a significant hazard. It is likely the erosion rates of bluffs and banks within ravines is lower yet it is unknown by how much. A significant factor in ravine bluff and bank erosion is the presence or absence of subsurface tile drains entering into a ravine. Tile drains often accumulate flow from a large area before exiting into a ravine. This drained area may be greater than the area typically draining into the ravine, leading to increased erosion. (Day, 2013)

Landslides and groundwater sapping are being studied in Blue Earth County as a contributor to bluff erosion near river channels. It is suspected that landslides in Blue Earth County are common and have historically been attributed exclusively to riverine erosion. Many of the landslide warning signs have been observed near river channels and bluffs in Blue Earth County. For example, new sites of groundwater sapping or seeps are observed or are changing and large, newly formed cracks in the ground within feet of the top of bluffs.

The USGS lists landslide warning signs and areas prone to landslide hazards. (USGS, Landslides 101, http://landslides.usgs.gov/learning/ls101.php)

USGS Areas that are generally prone to landslide hazards:

- On existing old landslides.
- On or at the base of slopes.
- In or at the base of minor drainage hollows.
- At the base or top of an old fill slope.
- At the base or top of a steep cut slope.
- Developed hillsides where leach field septic systems are used.

USGS Landslide Warning Signs:

- Springs, seeps, or saturated ground in areas that have not typically been wet before.
- New cracks or unusual bulges in the ground, street pavements or sidewalks.
- Soil moving away from foundations.
- Ancillary structures such as decks and patios tilting and/or moving relative to the main house.
- Tilting or cracking of concrete floors and foundations.
- Broken water lines and other underground utilities.
- Leaning telephone poles, trees, retaining walls or fences.

5.3.16.E. VULNERABILITY ASSESSMENT

Proximity to water features and woodlands make river corridors and ravines desired locations for residential construction. The greatest population density along rivers is in within the lower 23-27 miles of the incising reaches of the Blue Earth River and its tributaries.

❖ Critical Facilities

There are electrical and other utilities lines located in potential hazard areas, especially near ravines and river crossings.

❖ Building Inventory

The building inventory assessment includes all structures within 30 feet of bluffs and within 50 feet from bluffs identified in the *Special Hazard Mitigation Risk Assessment of Near Channel Riverine Erosion Hazards in Blue Earth County - Streambanks, Bluffs, and Ravines*. The location of structures was determined from 2012 LiDAR which shows the approximate location of building footprints. The value of structures was determined using 2013 Blue Earth County Assessor's data.

Buildings within 30 feet of Bluffs

- 89 structures
- Value - $6,501,900

Buildings within 50 Feet of Bluffs

- 267 structures
- Value $11,531,100

❖ Infrastructure

The infrastructure analyzed for near channel erosion is limited to roadways, wastewater treatment facilities and water supplies.

Using average measured erosion rates where available and the average erosion rate for each river where measurements are not available the number of road segments that could be threatened (within 33 feet) by bluff erosion in the next 100 years. Within Blue Earth County the potential exists for 186 miles of road to be at risk of bluff erosion hazards alone in the next 100 years. (Day 2013)

The City of Mankato's water wells are located in Land of Memories Park is located in an area vulnerable to near channel erosion. Municipal wastewater treatment facilities located in areas determined to be vulnerable to near channel erosion are owned by the City of Good Thunder, City of St. Clair, City of Pemberton and the City of Vernon Center.

Summary

- 338 miles of rivers and streams with stream banks
- 900 bluffs
- 295 ravines
- 186 miles of roadway within 30 feet of bluffs
- 89 structures within 30 feet of bluffs - $6,501,900 current assessed value
- 267 structures within 50 feet of bluffs - $11,531,100 current assessed value
- 4 municipal wastewater treatment facilities in hazard area
- 2 municipal wells in hazard area

REFERENCES

Day, Stephanie, 2013, Special Hazard Mitigation Risk Assessment of Near Channel Riverine Erosion Hazards in Blue Earth County - Streambanks, Bluffs, and Ravines

EPA, Watershed Assessment of River Stability & Sediment Supply (WARSSS), 2013 http://water.epa.gov/scitech/datait/tools/warsss/

EPA, WARSSS, Channel Processes: Streambank Erosion http://water.epa.gov/scitech/datait/tools/warsss/streamero.cfm

EPA, WARSSS, Channel Processes: Channel Enlargement http://water.epa.gov/scitech/datait/tools/warsss/enlarge.cfm

EPA, WARSSS, Channel Processes: Gully Erosion http://water.epa.gov/scitech/datait/tools/warsss/gullyero.cfm

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FEMA, 1999, Riverine Erosion Hazard Mapping Feasibility Study.

USGS, 1982, Landslide Overview Map of the Conterminous United States. http://landslides.usgs.gov/learning/nationalmap/

USGS, Landslides 101, http://landslides.usgs.gov/learning/ls101.php

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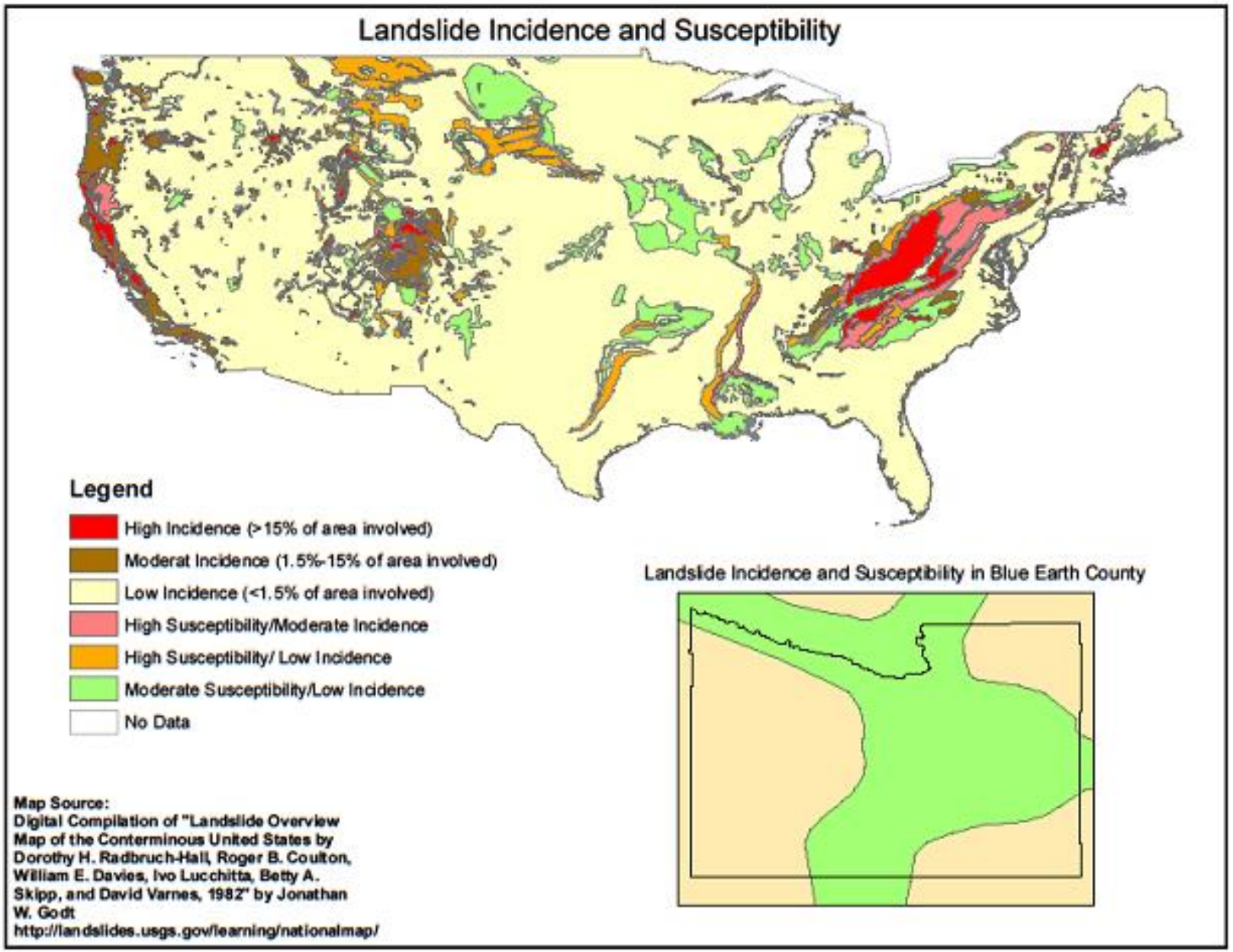
Attachment 1: Landslide Overview Map of the Conterminous United States



6.0 MITIGATION STRATEGIES

The goal of mitigation is to minimize the impact from hazard events on the County. This applies to property damage, loss of life, and the economic disruption that can accompany the most serious of disasters. Identifying which hazards are the most likely to adversely impact the County and quantifying the risk they pose is only part of the picture of hazard mitigation. The next step is identifying specific mitigation goals and strategies that can be pursued at the County and city levels in order to achieve the goal of disaster resistant communities.

6.1 CURRENT ACTIVITIES

Blue Earth County already undertakes a variety of policies/regulations/programs that contribute to the lessening of disaster damages. The following subsections identify existing mitigation activities within all of the communities listed in Section 1.2 of this plan.

6.1.1 NATIONAL FLOOD INSURANCE PROGRAM (NFIP)

Blue Earth County and 4 cities participate in the National Flood Insurance Program. The latest Flood Insurance Rate Map (FIRM) that was completed for the county was in 1999.

As of February 2011 there were a total of 80 policies active in the County, insuring a total of $20,263,000.[117] According to the National Flood Insurance Program's BureauNet report on policy and loss, as of May 31, 2012 Blue Earth County had 107 NFIP policies. There have been 50 claims for $553,094 on those properties since January 1, 1978. Figure 6-1 identifies each community and the date each participant joined the NFIP.

Figure 6-1: NFIP Participation (as of 7/23/12)[118]

Community	Participation	Initial FIRM Date	Current Eff. Map Date	Entry Date
Blue Earth County	Yes	11/25/72	7/21/99	11/24/72
Lake Crystal	Yes	7/3/85	7/3/85	7/3/85
Mankato	Yes	12/22/72	11/20/00	12/22/72
St. Clair	Yes	NA	NSFHA	6/30/98
Amboy	No	NA	NA	NA
Eagle Lake	No	NA	NA	NA
Good Thunder	Yes (E)	NA	NA	3/26/97 (E)
Madison Lake	No (enrollment started)	NA	NA	NA
Mapleton	No	NA	NA	NA
Pemberton	No	NA	NA	NA
Skyline	No	NA	6/27/75	NA
Vernon Center	No	NA	1/3/75	NA

(E) = Emergency Program (less coverage available)
(NSFHA) – No Special Flood Hazard Area is mapped

6.1.2 PLANS AND ORDINANCES

Blue Earth County and its cities and townships have a variety of plans and ordinances currently in place that work towards mitigating hazards. Below are the survey results detailing the plans/ordinances of the jurisdictions.

Figure 6-2: Local Plans

City(C)/Township(T)	Local Comprehensive Plan	General Land Use Plan	Sustainability Plan	Capital Improvement Plan	Redevelopment Plan	Post-Disaster Redev't /Recovery Plan	Regional Dev't Plans	Watershed Protection/ Enhancement Plan	Open Space Plan	Flood Mitigation Plan	College Campus Plan	Comp. Emergency Management Plan	Evacuation Plans
Mankato (C)	X	X	X	X	X		X	X	X		X		
Good Thunder(C)												X	
Madison Lake(C)	X			X								X	X
Vernon Center(C)													X
Skyline(C)													
Pemberton(C)				X									X
Mapleton(C)													
Amboy(C)		X		X								X	X
Eagle Lake(C)	X	X		X					X				
Lake Crystal(C)		X										X	
St. Clair(C)	X											X	
Cambria(T)								X				X	X
Pleasant Mound(T)	X	X											
Medo(T)													
Sterling(T)													
Ceresco(T)													
Jamestown(T)													
Rapidan(T)													
Lyra(T)	X					X		X		X		X	
Decoria(T)													
Le Ray(T)		X		X									
Beauford(T)													
Lincoln(T)													
Mankato(T)	X	X					X	X			X	X	X
Judson(T)													
Shelby(T)													
Lime(T)	X	X											
Garden City(T)	X									X			X

City(C)/Township(T)	Local Comprehensive Plan	General Land Use Plan	Sustainability Plan	Capital Improvement Plan	Redevelopment Plan	Post-Disaster Redev't /Recovery Plan	Regional Dev't Plans	Watershed Protection/ Enhancement Plan	Open Space Plan	Flood Mitigation Plan	College Campus Plan	Comp. Emergency Management Plan	Evacuation Plans
Butternut Valley(T)													
Danville (T)													
McPherson (T)													
Mapleton (T)													
South Bend (T)													
Vernon Center (T)													

Figure 6-3: Local Codes, Regulations, and Procedures

City(C)/Township(T)	Zoning Ordinance	Subdivision Regulations	Building Code/Permitting	Landscape Code	Solid Waste & Hazardous Materials Waste Regulations	Property Deed Restrictions	Tree Protection Ordinance	Site Plan Review	Architectural/Design Review	Storm Water Management	Soil Erosion Ordinance
Mankato (C)	X	X	X	X	X		X	X	X	X	X
Good Thunder(C)	X	X	X								
Madison Lake(C)	X	X	X	X				X	X		
Vernon Center(C)	X	X									
Skyline(C)			X							X	
Pemberton(C)	X	X	X		X					X	
Mapleton(C)	X				X						
Amboy(C)	X		X	X							
Eagle Lake(C)	X	X	X					X			
Lake Crystal(C)	X	X	X		X						
St. Clair(C)	X	X	X		X			X		X	
Cambria(T)	X	X	X		X				X		
Pleasant Mound(T)	X							X			
Medo(T)											
Sterling(T)											
Ceresco(T)											
Jamestown(T)											
Rapidan(T)											
Lyra(T)	X		X		X					X	X

City(C)/Township(T)	Zoning Ordinance	Subdivision Regulations	Building Code/Permitting	Landscape Code	Solid Waste & Hazardous Materials Waste Regulations	Property Deed Restrictions	Tree Protection Ordinance	Site Plan Review	Architectural/Design Review	Storm Water Management	Soil Erosion Ordinance
Decoria(T)											
Le Ray(T)								X			
Beauford(T)											
Lincoln(T)											
Mankato(T)	X	X	X		X	X		X		X	
Judson(T)	X	X	X	X	X						
Shelby(T)											
Lime(T)	X	X	X								
Garden City(T)											
Butternut Valley(T)	X										
Danville (T)											
McPherson (T)											
Mapleton (T)											
South Bend (T)											
Vernon Center (T)											

6.2 MITIGATION GOALS

The Risk Assessment identified the hazards of Blue Earth County. In order to create a plan that better reflects best practices of the time, the original goals and objectives from the 2008 Hazard Mitigation Plan have been completely revised and updated in order to mirror those found in the State of Minnesota All-Hazard Mitigation Plan. This will allow the two plans to work together and assist the State in developing strategies that will better reflect local conditions.

The goals and objectives are categorized by the six mitigation measure categories from the *FEMA State and Local Mitigation Planning How to Guides*. These are:

- **Prevention:** Government, administrative, or regulatory actions or processes that influence the way land and buildings are developed and built. These actions also include public activities to reduce hazard losses. Examples include planning and zoning, building codes, capital improvement programs, open space preservation, and stormwater management regulations.

- **Property Protection:** Actions that involve the modification of existing buildings or structures to protect them from a hazard or removal from the hazard area. Examples include acquisition, elevation, structural retrofits, storm shutters, and shatter-resistant glass.

- **Public Education and Awareness:** Actions to inform and educate citizens, elected officials, and property owners about the hazards and potential ways to mitigate them. Such actions include outreach projects, real estate disclosure, hazard information centers, and school-age and adult education programs.

- **Natural Resource Protection:** Actions that, in addition to minimizing hazard losses, preserve or restore the functions of natural systems. These actions include sediment and erosion control, stream corridor restoration, watershed management, forest and vegetation management, and wetland restoration and preservation.

- **Emergency Services:** Actions that protect people and property during and immediately after a disaster or hazard event. Services include warning systems, emergency response services, and protection of critical facilities.

- **Structural Improvements:** Actions that involve the construction of structures to reduce the impact of a hazard. Such structures include dams, levees, floodwalls, seawalls, retaining walls, and safe rooms.

Figure 6-4: Natural Hazard Mitigation Goals, Strategies, and Objectives

Goal 1 – Flood: Reduce deaths, injuries, property loss and economic disruption due to all types of flooding (riverine, flash flooding)	
Mitigation Strategy	**Objectives**
Prevention:	Planning, technical studies, training, adoption of ordinances and legislation, acquisition and use of equipment, establishing shelters, and encouraging participation in NFIP and CRS will be used to prevent or reduce risks to lives and property from flooding.
Property Protection:	Acquisition, repair, or retrofitting of property and acquisition and use of equipment will be used to prevent or reduce risks to property from flooding.
Public Education and Awareness:	Public education and access to information will be used to raise public awareness of risks from flooding in order to prevent or reduce those risks.
Natural Resource Protection:	Stream corridor protection projects and restoration and soil erosion control projects will be used to prevent or reduce risks and increase the protection of natural resources from flooding.
Emergency Services:	Technological improvements, warning systems, responder training, emergency response services, acquisition and use of equipment, and planning will provide emergency services to prevent or reduce the risks to lives and property from flooding.
Structural Improvements:	Construction and maintenance of drains, sewer drainage and separation projects, floodwalls, dams, culverts, levees, roads, bridges, and general flood protection projects will be used to prevent or reduce damages from flooding, loss of services to critical equipment, and the risks they pose to lives, property, and the natural environment.
Goal 2 – Tornado: Reduce deaths injuries, property loss, and economic disruption due to tornadoes.	
Mitigation Strategy	**Objectives**
Prevention:	Adoption of ordinances and legislation, acquisition and use of equipment, planning, conducting technical studies, and establishing of shelters will be used to prevent or reduce risks to lives, property, and economic activity from

	tornadoes.
Property Protection:	Constructing safe rooms and storm shelters, and retrofits will be used to prevent or reduce risks to property from tornadoes.
Public Education and Awareness:	Warning systems, public education, and access to information will be used to raise public awareness of risks from tornadoes in order to prevent or reduce those risks.
Emergency Services:	Warning systems, technological improvements, responder training, planning, emergency response services, and acquisition and use of equipment will provide emergency services to prevent or reduce risks from tornadoes.
Structural Improvements:	Construction of storm shelter and safe rooms and maintenance of other structural projects will be used to prevent or reduce risks from tornadoes.
Goal 3 – Sinkholes and Land Subsidence: Reduce the threat to public health, property loss, damages to structures and infrastructure due to sinkholes and land subsidence.	
Mitigation Strategy	**Objectives**
Prevention:	Planning, technical studies, and building/development regulations will be used to prevent or reduce risks from sinkholes.
Property Protection:	Outreach efforts, public education and access to information will be employed to raise public awareness in order to reduce financial loss and risks to lives and property from sinkholes.
Public Education and Awareness:	Measures to reduce the volume of water passing into a sinkhole will be used in order to reduce financial loss, property damage, and threats to the public health and safety.
Goal 4 – Severe Winter Weather: Reduce deaths, injuries, property loss, and economic disruption due to severe winter weather.	
Mitigation Strategy	**Objectives**
Prevention:	Acquisition and use of equipment, adoption and enforcement of ordinances and legislation, planning, and technical studies will be used to prevent or reduce risk to the protection of lives, property, and economic activity from the risks from severe winter weather.
Property Protection:	Acquisition and use of equipment and vegetation management will be used to prevent or reduce risks to property from the risks from severe winter weather.
Public Education and Awareness:	Public education, warning systems, access to information, and outreach projects will be used to raise public awareness of the risks from severe winter weather in order to reduce those risks.
Emergency Services:	Acquisition and use of equipment, emergency response services, warning systems, technological improvements, planning, and responder training will provide emergency services to prevent or reduce risks from severe winter weather.
Structural Improvements:	Structural projects will be implemented and maintained to prevent or reduce risks from severe winter weather.
Goal 5 – Drought: Reduce economic, agricultural, and natural resource disruption due to drought.	
Mitigation Strategy	**Objectives**
Prevention:	Planning, acquisition and use of equipment, and technical studies will be used to prevent or reduce risks from drought.
Property Protection:	Water treatment measures will be used to prevent or reduce risks to property from drought.
Public Education and Awareness:	Public education and access to information will be used to raise public awareness of risks from drought in order to prevent or reduce those risks.
Natural Resource Protection:	Planning and implementing watershed plans will be used to prevent or reduce risks from drought.
Structural Improvements:	Technological improvements and acquisition of equipment for structural projects will be used to prevent or reduce risks from drought.

Goal 6 – Earthquake: Limit property damage, economic loss, and disruptions in commercial and industrial activities due to earthquake.	
Mitigation Strategy	**Objectives**
Prevention:	Planning, building code adoptions and management programs will be used to prevent or reduce risks to property and economic activity from earthquakes.
Property Protection:	Repair and retrofitting of structures will be used to prevent or reduce risks from earthquakes.
Public Education and Awareness:	Public education and access to information will be used to raise awareness of the risks from earthquakes in order to prevent or reduce those risks.
Emergency Services:	Planning, responder training, alert systems, establishing shelters, and technological improvements will provide emergency services to prevent or reduce risks from earthquakes.

The following hazards were not found in the State All-Hazard Mitigation Plan and were developed by using FEMA guidance.[119]

Figure 6-5: Hazard Mitigation Goals, Strategies, and Objectives for Other Hazards

Goal 7 – Infrastructure Failure: Decrease the risks to life and property from infrastructure failure.	
Mitigation Strategy	**Objectives**
Prevention:	Planning, technical studies, inspections, and encouraging participation in NFIP will be used to prevent or reduce risks from infrastructure failures.
Public Education and Awareness:	Public education will be used to raise awareness of risks from infrastructure failures in order to prevent or reduce those risks.
Natural Resource Protection:	Watershed management projects will be used to protect natural resources and prevent or reduce risks from infrastructure failures.
Emergency Services:	Planning, responder training, warning systems, emergency response services, technological improvements, and acquisition and use of equipment will provide emergency services to prevent or reduce risks from infrastructure failures.
Goal 8 – Hazardous Material Release: Limit property damage, loss of life, economic loss, and disruptions in commercial and industrial activities due to a hazardous material release.	
Mitigation Strategy	**Objectives**
Prevention:	Proper regulations and licensing will be utilized to reduce the risk from hazardous materials.
Property Protection:	Outfit structures with warning measures and protective features to mitigate the damages from the release of hazardous materials.
Public Education and Awareness:	Increase public awareness of what to do in the event of a hazardous material release and the hazardous material risk present in the community.
Emergency Services:	Increase capability of community fire departments and first responder's capability to respond to release incidents.
Goal 9 –Fires: Reduce deaths, injuries, property loss and economic disruption due to structural and wildfires.	
Mitigation Strategy	**Objectives**
Prevention:	Planning, technical studies, training, adoption of ordinances and legislation and acquisition and use of equipment will be used to prevent or reduce risks to lives and property from fires.
Property Protection:	Adopt state fire codes and inspect structure per local ordinance.
Public Education and Awareness:	Public education and access to information will be used to raise public awareness of risks from fires in order to prevent or reduce those risks.
Emergency Services:	Technological improvements, warning systems, responder training, emergency response services, acquisition and use of equipment, and planning will provide emergency services to prevent or reduce the risks to lives and property from fires.

Goal 10 – Severe Summer Weather: Reduce deaths, injuries, property loss, and economic disruption due to severe summer storms.	
Mitigation Strategy	**Objectives**
Prevention:	Acquisition and use of equipment, adoption and enforcement of ordinances and legislation, planning, and technical studies will be used to prevent or reduce risk to the protection of lives, property, and economic activity from the risks from severe summer storms.
Property Protection:	Acquisition and use of equipment and vegetation management will be used to prevent or reduce risks to property from the risks from severe summer storms.
Public Education and Awareness:	Public education, warning systems, access to information, and outreach projects will be used to raise public awareness of the risks from severe summer storms in order to reduce those risks.
Emergency Services:	Acquisition and use of equipment, emergency response services, warning systems, technological improvements, planning, and responder training will provide emergency services to prevent or reduce risks from severe summer storms.
Structural Improvements:	Structural projects will be implemented and maintained to prevent or reduce risks from severe summer storms.
Goal 11 – Infectious Disease: Limit loss of life, economic loss, and disruptions in commercial and industrial activities due to an infectious disease outbreak.	
Mitigation Strategy	**Objectives**
Prevention:	Proper regulations and licensing will be utilized to reduce the risk from infectious disease.
Public Education and Awareness:	Increase public awareness of what to do in the event of an infectious disease outbreak.
Emergency Services:	Increase capability of community response personnel to effectively respond to an infectious disease outbreak.
Goal 12 – Water Supply Contamination: Limit loss of life, economic loss, and disruptions in commercial and industrial activities due to water supply contamination.	
Mitigation Strategy	**Objectives**
Prevention:	Proper regulations and licensing will be utilized to reduce the risk from water supply contamination.
Property Protection:	Outfit wells and reservoirs with warning measures and protective features to mitigate the damages from water supply contamination.
Public Education and Awareness:	Increase public awareness of what to do in the event of water supply contamination.
Emergency Services:	Increase capability of community response personnel to effectively respond to water supply contamination.
Goal 13 – Animal and Crop Disease: Limit the potential loss to Blue Earth County's livestock and crop assets from infectious disease.	
Mitigation Strategy	**Objectives**
Prevention:	Proper regulations and licensing will be utilized to reduce the risk from animal and crop disease.
Property Protection:	Ensure zoning ordinances are enforced in order to limit the potential spread of a disease if it is found within the County.
Public Education and Awareness:	Increase public awareness, specifically targeting farmers and agricultural workers, of what to do in the event of a large scale animal or crop disease incident..
Goal 14 – Invasive Species: Limit the potential loss to Blue Earth County's agricultural and natural resources in the event of a invasive species outbreak.	
Mitigation Strategy	**Objectives**

Prevention:	Proper regulations and licensing will be utilized to reduce the risk from invasive species.
Property Protection:	Ensure zoning ordinances are enforced in order to limit the potential spread of an invasive species if it is found within the County.
Public Education and Awareness:	Increase public awareness about what can be done to mitigate the spread of invasive species.
Goal 15 – Terrorism: Ensure Blue Earth County public facilities are prepared for a terrorist threat and that first responder personnel are prepared in how to respond to such a threat	
Mitigation Strategy	**Objectives**
Property Protection:	Ensure public facilities in the county have appropriate security measures in place to reduce their risk to terroristic threats.
Public Education and Awareness:	Ensure appropriate communication measures are in place to effectively communicate with the public in the event of a terroristic incident.
Emergency Services:	Ensure first responders have appropriate training to deal with a wide variety of terrorist threats.
Goal 16 – *Riverine and Ravine Erosion and Landslides*: Limit the potential property loss and economic impact from river and ravine erosion and landslides in Blue Earth County.	
Mitigation Strategy	**Objectives**
Prevention:	• Support continued investigation of near channel erosion hazards and development of predictive models and methods to analyze the unique near channel erosion and riverine evolution processes in Blue Earth County so that more specific erosion hazard area boundaries can be identified and development steered away from hazard areas with local plans and zoning ordinances. • Support continued investigation of near channel erosion caused by groundwater sapping and landslides. • Recommend ground assessment and site specific analysis of vulnerability prior to building in potential hazard areas.
Natural Resource Protection BMPs and Structural Practices:	• Support construction of grade control structures to control the head-cut advancement of ravines. • Control stormwater runoff to prevent convergence of surface water to prevent channelized flow and the formation of gullies. • For existing roads, not concentrating surface or intercepted sub-surface runoff onto high risk slopes, dispersing runoff. • Manage sub-surface flow discharges. • Maintain buffers of deep rooted, permanent vegetation in shore and bluff impact zones and areas near river, stream and ravine channels. • Support construction of stream bank and stream channel restoration when necessary to protect dwellings and infrastructure. • Support relocation of dwellings and infrastructure to prevent loss of property.
Public Education and Awareness:	• Increase public awareness, specifically targeting individuals and businesses located in high risk areas, of the potential threat of riverine and ravine erosion and landslides. • Support development of information and technical papers for elected officials, conservation, planning and zoning staff, and landowners making land use decisions in areas of near channel erosion hazards.

6.3. HAZARD MITIGATION ACTIONS

Individual communities in Blue Earth County, as well as key stakeholders at the County level, were approached to evaluate the current actions listed in the existing plan as well as to suggest and develop new actions for the 2013 update. The two main factors that stakeholders were asked to evaluate were Cost and Funding. These two ratings were combined with the hazard's Probability and Severity from the county wide surveys discussed in section 5.2.7. Figure 6-6 below details the specific rationale behind each rating.

Figure 6-6: Mitigation Action Ranking Rubric

Cost
3 = Less than $5,000 2 = $5,000 to $25,000 1 = More than $25,000
Funding
3 = Existing funding sources; Available staff time 2 = Identified potential funding sources and staff time 1 = No identified funding sources or staff time
Probability
3 = High 2 = Medium 1 = Low
Severity
3 = Significant 2 = Moderate 1 = Minimal

This scale was designed so that in all categories higher numbers represent a higher priority for the plan. In the monetary categories of Cost and Funding, higher numbers represent easier projects to complete from a fiscal standpoint; in the hazard categories of Probability and Severity, higher numbers represent more dangerous hazards which should receive higher priority in the plan. The decision was made so that the hazard categories had a larger point scale than the monetary categories, with the rationale being that the potential effects of the hazards deserved a slightly higher consideration than the funding possibilities.

These four ratings were combined into a composite score for each hazard, an example of which is shown below in Figure 6-7. For mitigation actions that were identified as impacting all hazards, the average Probability and Severity score for all other hazards was used. See Section 8.3 for a complete listing of all mitigation action scores.

Figure 6-7: Example Hazard Score

Mitigation Action	Priority/ Status	Hazard Addressed	Mitigation Strategy	Cost	Funding	Probability	Severity	Total
Upgrade water main infrastructure to 6 or 8 inch pipes.	Low/New	Flood	SI	**1**	**1**	**1**	**2**	**5**

The composite score was utilized to create a Priority rank for each hazard, as shown in Figure 6-8. In this way, even though a comprehensive benefit cost analysis was not completed for

each individual mitigation action, the rankings present in the plan represent a strong consideration by all jurisdictions involved of cost, benefit, and the potential impact the action would have on the community.

Figure 6-8: Mitigation Action Priority Ranking

Score	Priority
4-6.5	Low
6.5-8	Medium
>8	High

In addition Actions were categorized into three main areas:

- **New** – Actions new to this update.
- **In Progress** – Actions that are currently being worked on.
- **Ongoing** – Actions that require ongoing maintenance and involvement.

The legend below shows which mitigation strategy is utilized by each action.

Figure 6-9: Mitigation Strategy Legend

Strategy	Code
Prevention	P
Property Protection	PP
Public Education	PE
Natural Resources Protection	NR
Emergency Services	ES
Structural Improvements	SI

6.3.1 BLUE EARTH COUNTY

The following table outlines the mitigation actions that have been identified as priorities at the county level. These actions include those taken by county staff as well as those undertaken by township boards across the county. Each action listed identifies a department that is responsible for implementation. Actions that are identified as County Wide indicates that this is a project with no sole departmental oversight, but rather a number of entities throughout the county are responsible for its implementation. A list of county departments involved in hazard mitigation activities and their contact information is listed in Figure 6-10 below.

Figure 6-10: County Departments Involved in Hazard Mitigation

Department	Contact
Emergency Management	507-304-4800
Public Health Services	507-304-4175
Planning/Zoning	507-304-4381
Administrator's Office	507-304-4235

Figure 6-11: County and Township Mitigation Actions

Mitigation Action	Priority/ Status	Hazard Addressed	Mitigation Strategy	Implementation
Continue to adequately fund emergency Response staff.	Medium/ Ongoing	All-Hazards	SI	Countywide
Assure availability of information for non-English speaking residents throughout Blue Earth County.	Low/ Ongoing	All-Hazards	SI	Public Health Services
Encourage the public to listen to local news sources, including television and radio broadcasts.	Medium/ Ongoing	All-Hazards	PP	Emergency Management
Continue to administer the National Flood Insurance Program (NFIP).	High/ Ongoing	Flood	ES	Emergency Management, Planning/Zoning
Work to get FEMA approval for a letter of Map amendment removing structure determined by staff to be out of the floodway designated as such instead of mistakenly identified by FIRM maps as existing within the floodway.	High/In Progress	Flood	ES	Planning/Zoning
Publish public notices and educational information to inform citizens of the purpose and content of regulations, as well as the need for flood insurance.	High/ Ongoing	Flood	PE	Emergency Management, Planning/Zoning
Maintain or replace levees, storm water drains or other flood reduction structures to prevent damage to structures/utilities due to flooding.	Medium/ Ongoing	Flood	PE	Countywide
Have items readily available for victims and responders in all Blue Earth County communities and areas. Flood responders should have proper equipment available to assist those who need help in times of a flood.	Medium/ Ongoing	Flood	PE	Emergency Management
Work with hospitals, nursing homes, schools, and civic centers to see that adequate shelter areas are designated.	High/ Ongoing	Tornado, Severe Winter Weather, Severe Summer Weather	SI	Emergency Management, Public Health
Enforce the County requirement that all manufactured home parks included a storm shelter.	Medium/ Ongoing	Tornado, Severe Winter Weather, Severe Summer Weather	ES	Planning/Zoning
Undertake community education and drills to prepare residents for severe weather storm events.	High/New	Tornado, Severe Winter Weather, Severe Summer Weather	ES	Emergency Management
Utilize city ordinances to discourage placement of trees near power lines.	High/ Ongoing	Tornado, Severe Winter Weather, Severe Summer Weather	P	Countywide
Utilize easements of right of way for ease of utility management.	High/New	All Hazards	PE	Countywide
Continue to utilize severe storm spotter network in all Blue Earth County cities.	High/ Ongoing	Tornado, Severe Summer Weather	PE	Emergency Management
Continue to assure development,	Medium/	Tornado, Severe	ES	Emergency

Mitigation Action	Priority/ Status	Hazard Addressed	Mitigation Strategy	Implementation
improvement, and maintenance of Early Warning Systems in all Blue Earth County communities.	Ongoing	Winter Weather, Severe Summer Weather		Management, Sheriff
Provision of proper equipment for all Blue Earth County fire departments.	Low/ Ongoing	All Hazards	PE	Countywide
Participation by all Blue Earth County cities in MNWARN resource sharing program.	Medium/ Ongoing	All Hazards	PE	Countywide
Ensure safety of elderly residents throughout all Blue Earth County communities in times of extreme heat and cold.	Medium/ Ongoing	Tornado, Severe Winter Weather, Severe Summer Weather	ES	Emergency Management, Public Health
Utilization of water conservation strategies in city ordinances, such as use restrictions in times of drought.	High/New	Drought, Fire	P	Countywide
Develop increased protection measures for residential water supplies and systems throughout Blue Earth County.	Medium/ New	Water Supply Contamination	SI	Countywide
Continue engaging in well head protection best management practices throughout all Blue Earth County communities.	High/ Ongoing	Water Supply Contamination	PE	Countywide
All Blue Earth County cities should adopt and maintain building and fire codes if they have not already done so.	Medium/ In Progress	Fire	ES	Planning/Zoning
Evaluate and maintain mutual aid agreements between fire departments in adjoining communities and between townships and cities.	High/ Ongoing	All Hazards	PE	Countywide
Participate in state Fire Prevention Week.	Medium/ Ongoing	Fire	PE	Countywide
Inspect all Blue Earth County dams and reservoirs to ensure structural integrity and safety.	Medium/ New	Infrastructure Failure	P	Public Works
Annual review of security measures at government buildings throughout Blue Earth County to ensure current practices are adequate.	Medium/ New	Terrorism	P	Sheriff's Office, Administrator's Office
Collaborate with local, state, and federal agencies to maximize efficiency and coordination in the event of a hazard incident.	Medium/ Ongoing	All-Hazards	P	Emergency Management
Enforce and update all County hazard regulations as needed in order to protect the health, safety, and general welfare of the County	High/ Ongoing	All-Hazards	P	Planning/Zoning
Provide continual training for emergency response personnel that are likely to be involved with the immediate effects of a hazard event.	Medium/ Ongoing	All-Hazards	ES	Countywide
Continue to provide public outreach and education regarding disaster preparedness to all Blue Earth County	Medium/ Ongoing	All-Hazards	PE	Emergency Management

Mitigation Action	Priority/ Status	Hazard Addressed	Mitigation Strategy	Implementation
communities.				
Continue to seek out funding for the creation of a brochure for the public detailing how to survive on your own in the event of a large scale disaster.	Low/New	All-Hazards	PE	Emergency Management
Ensure the Blue Earth County residents whose primary language is not English have easy access to critical hazard information.	Low/New	All-Hazards	PE	Public Health
Ensure County floodplain maps accurately reflect the most up to date data available.	Medium/ Ongoing	Flood	P	Planning/Zoning
Ensure County staffs are prepared for a disease outbreak concerning livestock.	Medium/ Ongoing	Animal and Crop Disease	ES	Planning/Zoning, Emergency Management
Review current zoning ordinances to ensure they are designed to reduce the risk of disease spreading from livestock.	Medium/ Ongoing	Animal and Crop Disease	P	Planning/Zoning
Continue to ensure placement of severe weather radios in schools and county buildings.	Medium/ In Progress	Tornado, Severe Winter Weather, Severe Summer Weather	ES	Emergency Management
Continue to distribute educational material to the public via websites, handouts, and public presentations.	Medium/ Ongoing	All-Hazards	PE	Emergency Management
Create a staff transition plan to ensure that knowledge and expertise of existing staff is carried on to successors.	High/New	All-Hazards	ES	Administrator's Office
Provide health education to private businesses where the risks of infectious diseases are a concern.	Medium/ Ongoing	Infectious Disease	PE	Public Health Services
Continue collaborating with the Mayo Health System to encourage participation in vaccination programs for all Blue Earth County residents.	Medium/ Ongoing	Infectious Disease	PE	Public Health Services
Continue reviewing the Emergency Operations Plan to ensure it adequately details the needed steps to respond to all potential hazards.	High/ Ongoing	All-Hazards	ES	Emergency Management
Encourage development of parks and open space areas along floodplain areas that consistently flood.	Medium/ New	Flood	PP	Emergency Management, Public Works, Administrators Office
Encourage all agencies to evaluate their exposure to a cyber attack and plan data backups appropriately.	Medium/ New	All Hazards	P	Countywide
Improve township roads to make them more resistant to flooding	Low/New	Flood, Infrastructure Failure	SI	Township Board

Mitigation Action	Priority/ Status	Hazard Addressed	Mitigation Strategy	Implementation
Ensure township roads are resistant to erosion	Low/New	River and Streambank Erosion, Infrastructure Failure	SI	Township Board
Ensure bridges on township roads are well maintained.	Low/New	Flood, Infrastructure Failure	SI	Township Board, Public Works
Conduct rock rip rap along county roads that are susceptible to erosion damage, such as CSAH 10, CSAH 16, and CSAH 8.	Medium/ New	Riverine and Ravine Erosion	SI	Public Works, Planning/Zoning
Purchase new response vehicle for the River Valley Tactical Team	Low/New	Terrorism	ES	Sheriff's Office

6.3.2 CITY MITIGATION ACTION

Figure 6.12 below lists the mitigation actions that have been identified for each city within the county. Some actions are labeled as "All Cities" which indicates they should be pursued by all local jurisdictions within the county, while some are targeted at individual cities.

Figure 6-12: City Mitigation Actions

Jurisdiction	Mitigation Action	Priority/ Status	Mitigation Strategy	Hazards Addressed
All Cities	Work to decrease strain on city sewers from unofficial sources.	Medium/Ongoing	P	Flood
All Cities	Improve city infrastructure system to ensure appropriate water volumes are met in all areas of the city.	Medium/In Progress	SI	Flood
All Cities	Ensure that city infrastructure has redundancies in place in the case of power outages during a hazard event.	Low/Ongoing	SI	Infrastructure Failure
All Cities	Ensure that dams and other critical infrastructure are fully functional and structurally sound.	Low/Ongoing	SI	Infrastructure Failure
All Cities	Ensure infrastructure and procedures are in place to provide adequate warning of severe weather events to residents.	Medium/Ongoing	P, PE	Severe Summer Weather, Tornado
All Cities	Identify areas at risk of riverine and ravine erosion and landslides and analyze the potential negative effects.	Low/New	P, NR	Riverine and Ravine Erosion and Landslides
All Cities	Improve city buildings to minimize their susceptibility to hazards.	Low/New	SI	All-Hazards
All Cities	Ensure fire departments have the appropriate equipment to fight wildfires.	Low/New	ES	Fire

Jurisdiction	Mitigation Action	Priority/ Status	Mitigation Strategy	Hazards Addressed
All Cities	Train all fire department personnel and other first responders in all Blue Earth county cities in proper hazardous material procedures.	Low/Ongoing	ES	Hazardous Material Release
All Cities	Utilization of water conservation strategies in city ordinances.	High/New	P	Drought
All Cities	Undertake community education and drills to prepare residents for severe weather storm events.	Medium/Ongoing	PE	Severe Summer Weather, Tornado
All Cities	Utilization of severe storm spotters network in all Blue Earth County cities.	High/Ongoing	ES	Severe Summer Weather, Tornado
All Cities	Create and maintain Mutual Aid Agreements for all Blue Earth County communities.	High/Ongoing	P	Fire
All Cities	Utilization of local zoning ordinances to regulate building density, use, bulk, height, and setbacks to assist in preventing fires from jumping from one structure to another.	Medium/New	P	Fire
All Cities	Utilize city ordinances to discourage placement of trees near power lines.	High/New	P	Infrastructure Failure
All Cities	Ensure cities have appropriate electronic backups of critical data in the event of a cyber attack.	Low/New	P	Terrorism
Amboy	Find and eliminate sources of inflow and infiltration into the city's water system	Medium/Ongoing	P	Flood
Amboy	Update water mains.	Medium/New	SI	Flood
Amboy	Update lift stations.	Medium/New	SI	Flood
Lake Crystal	Seek funding to replace the Lake Crystal Dam.	Low/New	SI	Flood
Lake Crystal	Integrate SCADA system into appropriate city facilities.	Low/New	SI	Terrorism
Lake Crystal	Expand water tower.	Low/New	SI	Fire
Mankato	Outfit flood station pumps with backup generators.	Medium/In Progress	SI	Flood
Mankato	Reduce stream bank erosion along the Minnesota and Blue Earth Rivers affecting the Land of Memories Campground.	Medium/In Progress	NR	Riverine and Ravine Erosion and Landslides

Jurisdiction	Mitigation Action	Priority/ Status	Mitigation Strategy	Hazards Addressed
Mankato	Upgrade water treatment plant.	Low/New	SI	Water Supply Contamination, Infrastructure Failure
Mankato	Bury power lines in areas that are susceptible to storm damage.	Low/New	SI	Infrastructure Failure
Mankato	Purchase back-up generator for flood station pumps	Low/New	SI	Flood
Mapleton	Continue efforts to remove foundation drains from the sanitary sewer system.	Medium/New	P	Flood
Mapleton	Install gutters on city hall and public works buildings.	Medium/New	PP	Severe Summer Weather
Pemberton	Lift Station pump upgrade 2010	High/Completed	SI	Flood
Pemberton	Acquire a new water tower due to age of current tower	Medium/New	SI	Infrastructure Failure
Pemberton	Purchase tornado siren due to lack of coverage or the current siren and age of the current siren	Medium/New	P, PE	Severe Summer Weather, Tornado
Pemberton	Build a new fire hall building due to age and adaptability	Medium/New	SI	Infrastructure Failure
Pemberton	Acquire a new well due to age and deterioration	Medium/New	SI	Infrastructure Failure
Pemberton	Fix surface water problem on 2nd & 3rd Avenues due to potential flooding problems deterioration of road surface and bed	Medium/New	SI	Flood
Pemberton	Shelter at Main Street Plaza and Fire Hall in case of disaster	Medium/New	P, ES	Severe Winter &Summer Weather, Tornado
Skyline	Installed new sewer and water lines in 2005	High/Completed	SI	Infrastructure Failure
Skyline	Install two back-up generators (20KW generator for city hall, and 40-60KW generator for the pump house)	Medium/New	P, ES	Tornado Severe Winter Weather
St. Clair	Install generator at Water Treatment Facility.	Low/New	SI	Infrastructure Failure
Vernon Center	Remove sources of inflow and infiltration.	Medium/New	P	Flood
Vernon Center	Seal manholes on city streets.	Medium/New	P	Flood

7.0 PLAN MAINTENANCE

7.1 MONITORING, EVALUATING, & UPDATING THE PLAN

Over the course of the next five-year cycle the Blue Earth County Sheriff's Office will work with Region Nine Development Commission to continually monitor and review the current plan content and make revisions and amendments as needed. The Emergency Management director will be responsible for maintaining email contact with the Stakeholder Taskforce and responding to questions that may arise about plan specifics.

The Sheriff's Office will hold an annual review meeting of the Stakeholder Taskforce. In addition to task force notification, this meeting will be posted at city halls, county courthouse, and websites to notify the public of the meeting. Region Nine staff representatives will be available to facilitate the meeting and guide the discussion.

At this meeting, members will discuss in more detail the development of mitigating hazards, action steps that have been taken over the 12 month period, and specific ways the current plan is succeeding or falling short. Initial ideas will be included in a progress report prepared by Region 9 to review and revise criteria of mitigating hazards, which would be forwarded back to all jurisdictions within the county.

Each entity's regulating authorities will consider adoption of plan revisions made at the review meeting. Cities will have reviews and conduct revisions with their Planning Commissions and City Council. The County Emergency Management Director and County Administrator (or equivalent staff position) will forward Plan revisions to appropriate departments (i.e., Public Works, Sheriffs, Facilities and Health). Ultimately, the County Board will consider final revisions to the Plan.

Applicable plans such as zoning ordinances, lakeshore ordinances, building codes, staff development plans, and waste water treatment policies will be amended to incorporated related changes. These amendments will be handled by local government entities (city council, planning commissions) at the city level. Blue Earth County officials, as well as city-level officials within the county, will be responsible for the integration of this All-Hazard Mitigation Plan into other applicable plans or planning mechanisms that they may already maintain or may be currently undertaking

Additionally, the Stakeholder Taskforce will be reconvened for a special meeting in the event of a major disaster or significant development in a particular hazard in the County. This meeting will determine if the plan needs to be updated immediately in order to take advantage of grant opportunities that may arise due to the new circumstances. If so, an amendment to the plan will be drafted at the meeting and distributed to the appropriate parties for adoption immediately.

7.2 IMPLEMENTATION THROUGH EXISTING PROGRAMS

The recommended actions and mitigation strategies detailed in this plan will be incorporated into the individual planning documents of the appropriate departments and communities at the County and city level. In the course of regularly scheduled updates to zoning plans and ordinances the County and cities will consult with the Hazard Mitigation Plan and see if their existing practices are in line with what has been determined to be the best way to reduce the risk and damage from hazards.

7.3 CONTINUED PUBLIC INVOLVEMENT

Ensuring that the public is actively involved has been a major priority of the planning process and this focus will continue after the plan is finalized and put into use. The full plan will be available in digital form both on the County Emergency Management website and the Region Nine Development Commission website. Education events held for specific hazards throughout the County will make mention of the plan and inform the public of its purpose. Public notice will be given for all annual review meetings and Stakeholder Taskforce members will be encouraged to bring interested parties with them to these meetings.

8.0 APPENDICES

8.1 SPECIAL HAZARD MITIGATION RISK ASSESSMENT OF NEAR CHANNEL RIVERINE EROSION HAZARDS IN BLUE EARTH COUNTY - STREAMBANKS, BLUFFS, AND RAVINES

DRAFT

Prepared by Stephanie Day

May 1, 2013

Blue Earth County is located at the downstream end of the Blue Earth watershed, which is made up of five large rivers, the Blue Earth, Le Sueur, Maple, Big Cobb, and Watonwan (Figure 1). The Blue Earth River reaches its confluence with the Minnesota River at the North central edge of Blue Earth County. Tributaries to the Minnesota River, including the Blue Earth River, are at a unique stage in their evolution making them at increased risk of riverine hazards particularly in the downstream areas. These hazards are intensified by anthropogenic alterations to the landscape. The following report will discuss the geologic evolution of the Blue Earth River watershed, modern anthropogenic impacts on riverine hazards, and the magnitude and location of hazards in Blue Earth County.

Blue Earth River Evolution

The evolution of the Blue Earth River begins with the retreat of the Laurentide ice sheet. As the ice sheet retreated, Glacial Lake Agassiz was formed behind a low moraine dam in what is today western Minnesota. At its greatest extent Glacial Lake Agassiz covered much of western Minnesota, eastern North Dakota, Manitoba and western Ontario (Upham 1890, 1895; Matsch 1972). Beginning 13,400 years ago Glacial Lake Agassiz catastrophically drained through its southern outlet carving Glacial River Warren, the valley where the Modern Minnesota River sits today. The valley was occupied until 12,800 years ago and again from 11,000 to 9,200 years ago when it lost glacial lake discharge (Thorleifson 1996; Lowell et al., 2005). When the incision ended, Glacial River Warren had incised though till, saprolites, and bedrock (Matsch, 1983) to create a valley 230 ft deep near Mankato. As the waters of Glacial River warren receded incision began on the tributaries, including the Blue Earth River. Like most rivers responding to a sudden base level drop, knickpoints were initiated on each of the tributary streams. Knickpoints on these rivers express themselves as slope discontinuities approximately 22 - 37 miles upstream from the Minnesota River. A more detailed discussion of knickpoints is available later in this report.

The geology of the Blue Earth Basin plays an important role in the incision and erosion rates. The rivers cut through loamy glacial till deposited by an unnamed phase of the Des Moines lobe. Variations within the till include sand lenses and areas of over-consolidated tills, which were over-compacted by a glacial advance after initial deposition (Day et al., 2013; Allred 1999; Kirkaldie and Talbot, 1992; Boulton 1976). In Blue Earth County the till is topped by approximately 10 ft of glaciolacustrine silt and clay deposited by Glacial lake Minnesota. Bedrock crops out in the far downstream portions of the rivers. A high resolution map of the

surficial geology of Blue Earth County (Figure 2) is available through the Minnesota Geologic Survey (Jennings, 2010).

Land Use and Land Cover History

Before the influence of humans the dominant land cover was prairie and wet prairie, with hardwood forests along the river corridors and in the northeastern portions of the watershed (Marschner, 1930; Minnesota Department of Natural Resources, 2007). Changes to land use and landcover began in the mid-1800s with European settlement. The two major changes that took place were conversion of wet prairie to agricultural fields and modification to hydrology through artificial drainage. Initial modification to hydrology was through the creation of a large public and private ditch network; later modification included installation of tile drainage systems. Both tile drains and ditches modify hydrology by seasonally reducing evapotranspiration, and in many places they expand the contributing area for a given river location. Hydrology was also modified through the conversion of perennial grasses to annual crops resulting in decreased evapotranspiration, especially in the spring and early summer before leaf out, or after harvest in the fall. A large percentage of the Blue Earth Basin is now cropland, primarily corn and soybean and almost all of the fields have artificial drainage. In addition to these human induced changes to hydrology climate change trends show a statewide increase in mean annual precipitation, and the number of intense rainfall events per year (Novotny and Stefan, 2007).

Knickpoint

Knickpoints are formed as a result of a sudden baselevel drop, or a drop in water level at the mouth of a river. There are many different types of knickpoints including waterfalls or slope discontinuities as exist in the Blue Earth Basin. The rate and form of knickpoint migration is dependent on the rate of fluvial incision, the resistance of the sediment and channel bed erosion processes (Whipple, 2001; Frankel et al., 2007). In a homogeneous substrate like the till in the Blue Earth Basin there are two forms of knickpoint retreat, rotation and replacement (Figure 3: Gardner, 1983; Frankel et al., 2007). The fine grained tills in the Blue Earth Basin are of intermediate resistance and therefore the knickpoint migrates primarily through replacement (Gardner, 1983; Frankel et al., 2007; Finnegan et al., 2010). The knickpoint will continue to migrate upstream until the river is fully evolved. The higher channel slope formed downstream of the knickpoint leads to increased channel erosion at this location. As a result the over-steepened section moves upstream.

This natural process is one reason for the high hazard risk in Blue Earth County. The ongoing incision creates steep valley walls, bluffs, and ravines. More importantly as incision progresses more bluffs are created and ravines deepen. Evolved channels may have wider floodplains where they rarely interact with bluffs, yet that are not the case in Blue Earth County.

Channel Evolution and Erosion History in the Blue Earth Basin

The Blue Earth watershed is unlike many other watersheds because it is still actively evolving to a rapid and significant base level drop. Fully evolved watersheds lack knickpoints, have well developed floodplains, and have a greater drainage density (Figure4). While hazards

exist in fully evolved watersheds the risk is often lower unless an outside force is leading to a change in the system.

Watershed evolution has been studied using a number of different tools. Using experiments researchers have shown that in response to a single rapid base level drop, channel incision and network expansion is rapid at first and slows over time (Figure: Parker, 1977). On the Le Sueur River in Blue Earth County a combination of field work and numerical modeling has been used to determine the incision and erosion volume history. Evidence shows that incision rates on the Le Sueur River have decreased over time, yet sediment loads have remained roughly the same since the incision began (Figure 5: Finnegan et al., 2010; Gran et al., 2011). The stable nature of the sediment loads suggest that while incision rates slowed, channel migration caused erosion on an increasing number of tall bluffs. The consistent nature of sediment loads through the Holocene also suggests that the modern increase in sediment loads from the Minnesota River and its tributaries, as seen in Lake Pepin, is due in large part to changes in land use and hydrology.

Hazards in Blue Earth County

Deeply incised rivers in Blue Earth County create unique hazards not seen in other areas in Minnesota. The geologic history of this area paired with modern land use, creates rivers highly susceptible to significant bluff failures, bank erosion, and ravine growth. In this report, and all corresponding maps, bluffs are defined as features with greater than 10 ft of relief in 30 ft x 30 ft area. Bluffs are tall steep features distinguished from banks based on their height. Initially a distinction between bluffs and banks was made for water quality studies, but the distinction is equally important when considering hazards. Like bluffs, banks erode as the river migrates toward them, but unlike bluffs banks periodically flood and can have sediment deposited on them. Flooding on banks is not the focus of this report, yet remains important for planning purposes. Ravines are distinct between bluffs or banks because they funnel water from uplands into the rivers. Ravines grow primarily by head-ward erosion at their far upstream end, yet like rivers, the banks and bluffs within ravines can also erode and fail. The primary hazard areas are near those banks, bluffs, and ravines that line the modern river channel. In places, these features (predominantly bluffs) have been cut off from the river due to channel migration. While features cut off from the river are likely to erode initially, they eventually stabilize in the absence of erosive power of the river.

The geology and geologic history of the area are a primary factor in the high hazard risk in Blue Earth County. As mentioned above the river are incising through thick tills deposited in the last glaciation. These tills are moderately erodible, but strong enough to form near vertical bluffs. The vertical nature of these features makes them susceptible to sudden and catastrophic failure. Evidence of such failures is documented in aerial photographs and the memories of landowners (Figure 6). While ravines contribute far less sediment to the system, the growth of these features can still be hazardous (Gran et al., 2011). As with bluffs, rapid ravine erosion is documented on through aerial photographs as well as in landowner memories. Unlike bluffs, ravines are often temporarily stabilized by landowners whose property is threatened. While the longevity and safety of these stabilization approaches is not documented there does appear to be some success in small ravines.

In addition to geology, hydrology also plays a critical role in the hazard risk in Blue Earth County. Natural and anthropogenic changes to hydrology result in a corresponding change in erosion and failure of banks, bluffs and ravines. As described earlier the significant change to hydrology has been an increase in water entering the river. This increase is due to reduction of evapotranspiration as a result of changing vegetation types, increase in drained area as a result of artificial drainage, and in part due changing storm intensity as a result of climate change. There is strong evidence to suggest that these changes to hydrology have resulted in increased erosion along rivers in Blue Earth County and therefore greater risk of hazards (Belmont et al., 2011; Gran et al., 2011; Day et al., 2013B).

Bluff Retreat Rates

Bluff retreat rates in Blue Earth County were measured using aerial photographs and terrestrial laser scanning (TLS: Day et al., 2013). Aerial photographs provide the average decadal retreat rate for 332 of the over 900 bluffs throughout Blue Earth County (Figure 7), while TLS provides annual bluff erosion on 15 bluffs on the Le Sueur, Maple, Big Cobb and Little Cobb Rivers. Rates of bluff retreat measured from aerial photographs range from 0 to 3 ft/yr with an average retreat rate of 0.56 ft/yr, and the average rates measured using TLS is remarkably similar ranging from -0.30 (deposition) to 1 ft/yr with an average of 0.66 ft/yr. Using measured rates where available and the average rate for each river where measurements are not available we can determine the number of road segments that will be threatened (within 33 ft) by bluff erosion in the next 100 years. Within Blue Earth county there is the possibility that 186 miles of road will be at risk from bluff hazards alone in the next 100 years (Figure 8). Improved estimates may become available after the completion of an ongoing study to improve our understanding of bluff erosion processes and the factors that cause some bluffs to erode faster than others.

Bluff erosion can occur through many different mechanisms. In the Blue Earth basin the primary mechanisms identified are over-steepening at the base of the bluff, freeze-thaw, and groundwater sapping. While each of these processes occurs naturally both over-steepening and groundwater sapping can be heavily influenced by human activity in the watershed. Freeze-thaw occurs in the spring and fall as water in bluffs freezes and expands then thaws and contracts. This process weakens the bluff making it seasonally more susceptible to failure. Groundwater sapping occurs where groundwater flows out through the face of a bluff. As the groundwater flows out it saturates and weakens the bluff sediment. The saturated sediment may be slowly eroded away as water flows over the bluff surface or may weaken the sediment to a degree where it is at greater risk of significant failure. Groundwater sapping can be intensified by lawn irrigation or due to septic fields placed such that water flows toward the river. Over-steepening at the base of the bluff is likely the most important process and takes place at every bluff connected to the river. Over-steepening occurs as the erosive power of the river removes material from the base of the bluff leading to increased slope. As the slope reaches a critical slope, which is dependent on many variables including the sediment type, moisture content, vegetation and others, it fails. The size of these failures is dependent in part on how over-steepened the bluff becomes before failure occurs. The rate of over-steepening is determined by the flow volume and velocity in the river. Changes to hydrology as have been discussed throughout

this report can lead to greater rates of over-steepening and therefore greater rates of erosion or failure.

Ravine Growth Rates

In Blue Earth County 295 ravines have been identified (Figure 9). Ravine growth has been measured on all ravines connected to the Le Sueur and Maple rivers. Of 63 ravines only 4 had grown more than 33 ft in 67 years (Figure 10). In many locations it appears that ravines have been stabilized by check dams or by placing rip rap or debris in the upstream head cut, yet places remain where ravines are rapidly eroding. Ravines grow in response to overland flow and groundwater flow at the head cut, yet the rates of growth are poorly documented, and no study has determined what factors cause some bluffs to grow faster than others.

Another area of research that remains unstudied is the erosion rate of bluffs and banks lining ravines. Like bluffs and banks on the river mainstem, bluffs and banks within ravines may be a significant hazard. It is likely the erosion rates of bluffs and banks within ravines is lower yet it is unknown by how much. A significant factor ravine bluff and bank erosion is the presence or absence of tile drains entering into a ravine. Tile drains often accumulate flow from a large area before exiting into a ravine. This drained area may be greater than the area typically draining into the ravine, leading to increased erosion.

Bank Erosion Rates

Bank erosion takes place by two processes, channel migration and channel widening. Channel migration occurs in all rivers and contributes to bank and bluff erosion along the full extent of the rivers in Blue Earth County. Migration rates of over 1.6 ft/yr have been recorded on rivers in Blue Earth County. Generally channel migration does not result in a net loss of sediment because all sediment lost is deposited along another bank downstream, yet there remains a hazard associated with channel migration and bank erosion. Channel widening occurs when the deposition that traditionally occurs during channel migration is absent. In the Blue Earth basin channel widening is occurring in response to changing hydrology. Channel widening rates range from 0.09 – 0.69 ft/yr. Erosion resulting from channel widening can also be a hazard for infrastructure near the channel.

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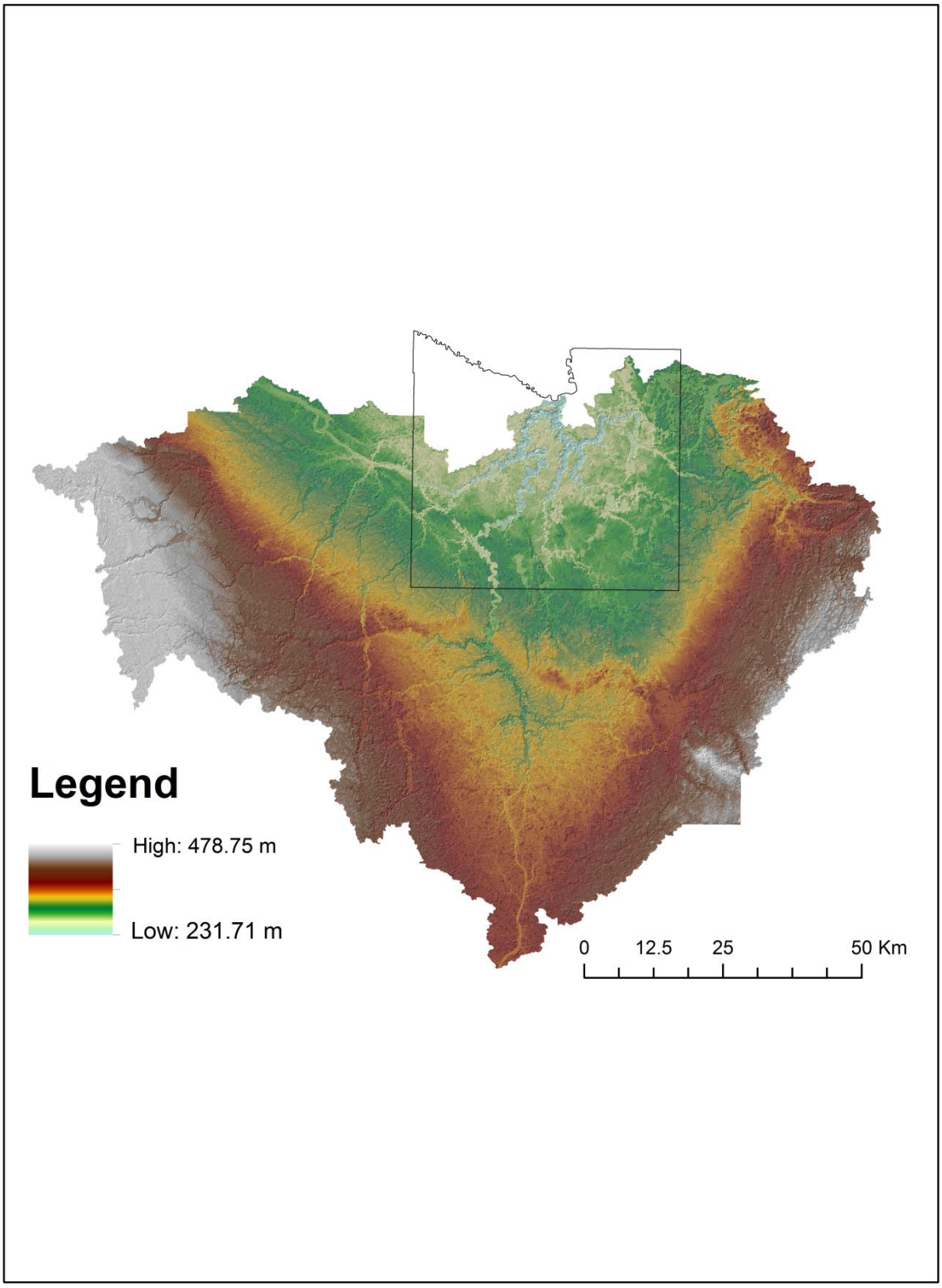


Figure 1: The location of Blue Earth County within the Blue Earth Watershed.

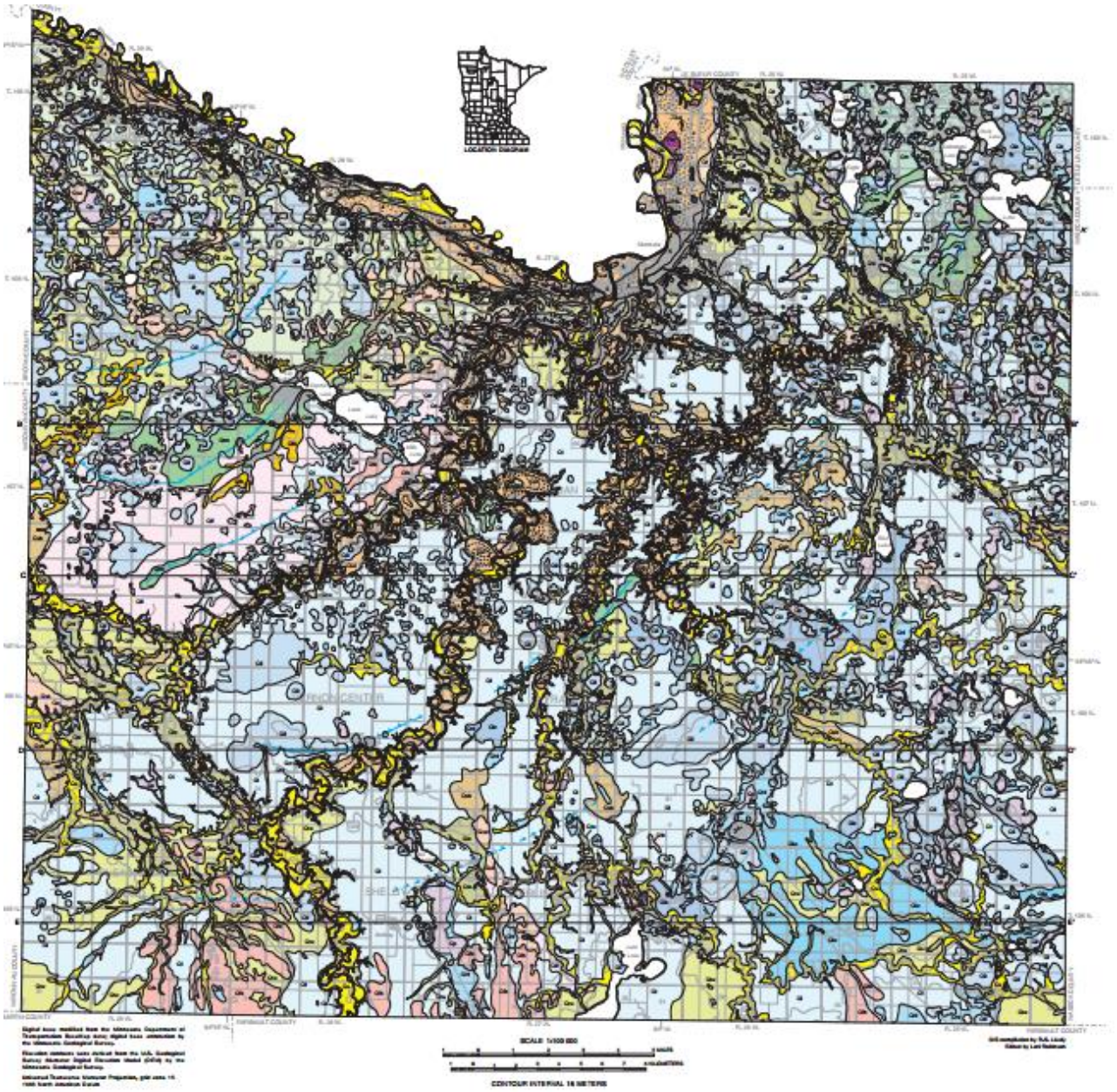


Figure 2: Geologic Map of Blue Earth County (Jennings 2010)

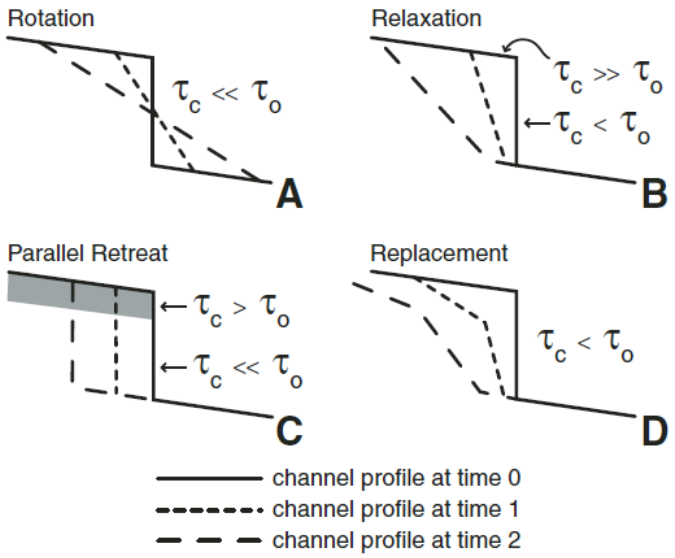
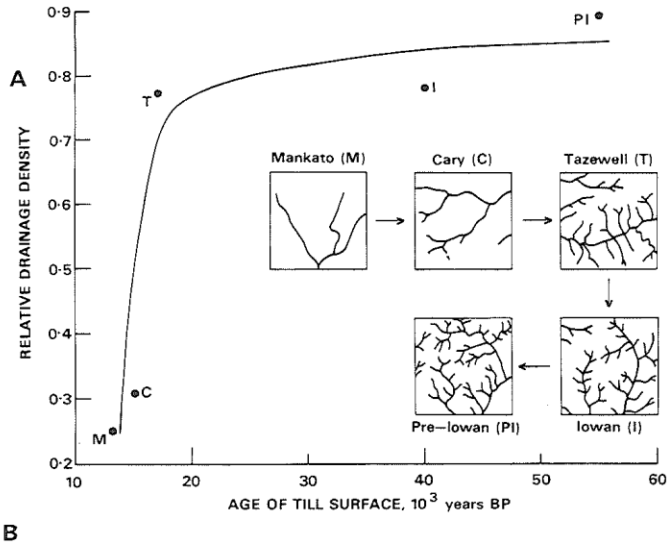


Figure 3: Knickpoint retreat varies based on the strength of material it is formed in. In the Blue Earth basin knickpoints move upstream via replacement. (Frankel et al., 2007)



8.2 ADOPTING RESOLUTIONS

8.3 SURVEYS

8.3.1 BLUE EARTH COUNTY HAZARD MITIGATION SURVEY OF LOCAL JURISDICTIONS

Section A – Preliminary Questions

1. Name of Jurisdiction: _____
2. Names and titles of those contributing to the completion of this survey

Risk Assessment*		
Hazard Name	**Hazard Probability**	**Hazard Impact**
Type: Naturally Occurring	*Probability - How likely is this hazard to occur? ("Low", "Moderate", "High")*	*Impact - If this hazard does occur, how much impact will it have on your community? (Minimal", "Moderate", "Significant")*
Flooding	*Low, Medium, High*	Minimal, Moderate, Significant
Wildfires	*Low, Medium, High*	Minimal, Moderate, Significant
Windstorms	*Low, Medium, High*	Minimal, Moderate, Significant
Tornadoes	*Low, Medium, High*	Minimal, Moderate, Significant
Hail	*Low, Medium, High*	Minimal, Moderate, Significant
Lightning	*Low, Medium, High*	Minimal, Moderate, Significant
River and Stream Bank Erosion	*Low, Medium, High*	Minimal, Moderate, Significant
Severe Winter Storms	*Low, Medium, High*	Minimal, Moderate, Significant
Landslide	*Low, Medium, High*	Minimal, Moderate, Significant
Sinkholes & Land Subsidence	*Low, Medium, High*	Minimal, Moderate, Significant
Earthquake	*Low, Medium, High*	Minimal, Moderate, Significant
Drought	*Low, Medium, High*	Minimal, Moderate, Significant
Extreme Temperatures	*Low, Medium, High*	Minimal, Moderate, Significant
Agricultural Animal / Crop Disease	*Low, Medium, High*	Minimal, Moderate, Significant
Type: Human Caused		
Water Supply Contamination	*Low, Medium,*	Minimal, Moderate, Significant

	High			
Structural Fire	*Low,*	*Medium,*	Minimal,	Moderate,
	High		Significant	
Hazardous Materials	*Low,*	*Medium,*	Minimal,	Moderate,
	High		Significant	
Infectious Disease	*Low,*	*Medium,*	Minimal,	Moderate,
	High		Significant	
Infrastructure Failure	*Low,*	*Medium,*	Minimal,	Moderate,
	High		Significant	
Terrorism	*Low,*	*Medium,*	Minimal,	Moderate,
	High		Significant	
Invasive Species	*Low,*	*Medium,*	Minimal,	Moderate,
	High		Significant	
Additional Hazards Not Listed				
Other:	*Low,*	*Medium,*	Minimal,	Moderate,
	High		Significant	
Other:	*Low,*	*Medium,*	Minimal,	Moderate,
	High		Significant	
Other:	*Low,*	*Medium,*	Minimal,	Moderate,
	High		Significant	

**Utilized to address 201.6(c)(2)(iii) of FEMA's Crosswalk Evaluation*

Blue Earth County Hazard Mitigation Survey of Local Jurisdictions
Section B – Preliminary Questions

3. Does your community participate in the National Flood Insurance Program? (FEMA **§**201.6(c)(3)(ii))

4. Since 2003 (when this planning process was last conducted), has your community taken any action to mitigate the occurrence or impact of any hazard? If yes, please describe and provide an approximate year. Infrastructure upgrades are an example of a potential hazard mitigation measures. *(FEMA §201.6(c)(3)(iii))*

5. Have you identified any actions that would reduce the occurrence or impact of any hazard but you have not yet implemented them? Please list. (FEMA *§201.6(c)(3)(iii))*
    a. What has prevented the implementation of these identified mitigation actions? (FEMA *§201.6(c)(3)(iii))*

6. Have there been any repetitive losses due to any hazard? Examples could include the repetitive loss of roads, utilities, public buildings, dwellings, parks, or private businesses. Please describe. **(***FEMA §201.6(c)(2)(ii))*

7. Are there existing buildings, infrastructure and critical facilities located in potential hazard areas? (*FEMA §201.6(c)(2)(ii)(A))*

8. Please list and describe any future buildings, infrastructure, and critical facilities that may be in a potential hazard area. (*FEMA §201.6(c)(2)(ii)(A)*)

9. What mechanisms for incorporating mitigation requirements into other local planning efforts are available to your community? Please check the policy documents below which are adopted by your community. Many of the items below may not pertain to your community but does provide a comprehensive listing of planning mechanisms. (FEMA *§201.6(c)(4)(ii)*)

Plans

___ - Local Comprehensive Plan
___ - General Land Use Plan
___ - Sustainability Plan
___ - Capital Improvements Plan
___ - Redevelopment Plan
___ - Post-Disaster Redevelopment / Recovery Plan
___ - Regional Development Plans
___ - Watershed Protection/Enhancement Plan
___ - Open Space Plan
___ - Flood Mitigation Plan
___ - College Campus Plans
___ -Comprehensive Emergency Management Plan
___ - Evacuation Plan

Codes, Regulations, & Procedures

___ - Zoning Ordinance
___ - Subdivision Regulations
___ - Building Code / Permitting
___ - Landscape Code
___ - Solid Waste & Hazardous Materials Waste Regulations
___ - Property Deed Restrictions
___ - Tree Protection Ordinance
___ - Site Plan Review
___ - Architectural/Design Review
___ - Storm Water Management
___ - Soil Erosion Ordinance

Programs

___ - Historic Preservation Program
___ - Construction/Retrofit Program
___ - Transportation Improvement/Retrofit Program
___ - School District Facilities Plan
___ - Environmentally Sensitive Purchase / Protection Program
___ - Long-Range Recreation Facilities Program
___ - Economic Development Authority
___ - Land Buyout Program
___ - Downtown Redevelopment Authority
___ - Local and/or Regional Evacuation Programs
___ - "Firewise" and other Fire Mitigation
___ - Fire Rescue Long-Range Programs
___ - Mutual Aid Agreement
___ - Temporary Animal Relocation Program

- Locations and description of hazards occurring in your community (dates of occurrences, and cost estimates on losses)

- Estimate of potential dollar loss of items identified in #6 of Section A, as well as describing a method of determination for this estimate. (FEMA *§201.6(c)(2)(ii)(B))*

- Return maps provided depicting responses to #7 from Section A on previous page (showing locations of structures or infrastructure in hazard areas).

- Please provide the community's Land Use Map and definition of categories. (FEMA *§201.6(c)(2)(ii)(C))*

- Map depicting projected potential development areas.

8.4 COMMUNITY HAZARD MITIGATION ACTION RATINGS

8.4.1 RATINGS BY BLUE EARTH COUNTY

Mitigation Action	Cost	Funding	Probability	Severity	Total	Hazard	Priority/Status
Continue to adequately fund emergency Response staff.	1	3	1.55	1.6	7.15	All-Hazards	Medium/ Ongoing
Assure availability of information for non-English speaking residents throughout Blue Earth County.	2	1	1.55	1.6	6.15	All-Hazards	Low/Ongoing
Encourage the public to listen to local news sources, including television and radio broadcasts.	3	1	1.55	1.6	7.15	All-Hazards	Medium/ Ongoing
Continue to administer the National Flood Insurance Program (NFIP).	2	3	1.91	1.85	8.76	Flood	High/Ongoing
Work to get FEMA approval for a letter of Map amendment removing structure determined by staff to be out of the floodway designated as such instead of mistakenly identified by FIRM maps as existing within the floodway.	3	2	1.91	1.85	8.76	Flood	High/In Progress
Publish public notices and educational information to inform citizens of the purpose and content of regulations, as well as the need for flood insurance.	3	2	1.91	1.85	8.76	Flood	High/Ongoing
Maintain or replace levees, storm water drains or other flood reduction structures to prevent damage to structures/utilities due to flooding.	1	2	1.91	1.85	6.76	Flood	Medium/ Ongoing
Have items readily available for victims and responders in all Blue Earth County communities and areas. Flood responders should have proper equipment available to assist those who need help in times of a flood.	1	2	1.91	1.85	6.76	Flood	Medium/ Ongoing
Work with hospitals, nursing homes, schools, and civic centers to see that adequate shelter areas are designated.	3	2	1.74	2.28	9.02	Tornado	High/Ongoing
Enforce the County requirement that all manufactured home parks included a storm shelter.	1	2	1.74	2.28	7.02	Tornado	Medium/ Ongoing

Mitigation Action	Cost	Funding	Probability	Severity	Total	Hazard	Priority/Status
Undertake community education and drills to prepare residents for severe weather storm events.	2	3	1.89	1.61	8.5	Severe Summer Weather	High/New
Utilize city ordinances to discourage placement of trees near power lines.	3	3	1.815	1.945	9.76	Tornado, Severe Summer Weather	High/Ongoing
Consider policy to regularly evaluate the condition of underground utilities.	3	3	1.45	1.7	9.15	Infrastructure Failure	High/New
Whenever possible utilize easements of right of way for ease of utility management.	3	3	1.45	1.7	9.15	Infrastructure Failure	High/New
Utilize severe storm spotter network in all Blue Earth County cities.	2	3	1.815	1.945	8.76	Tornado, Severe Summer Weather	High/Ongoing
Continue to assure development, improvement, and maintenance of Early Warning Systems in all Blue Earth County communities.	1	2	1.815	1.945	6.76	Tornado, Severe Summer Weather	Medium/ Ongoing
Provision of proper equipment for all Blue Earth County fire departments.	1	2	1.55	1.6	6.15	All-Hazards	Low/Ongoing
Participation by all Blue Earth County cities in the national FireWise wildfire education program.	3	2	1.44	1.47	7.91	Fire	Medium/ Ongoing
Ensure safety of elderly residents throughout all Blue Earth County communities in times of extreme heat and cold.	3	1	2.055	1.68	7.735	Severe Summer Weather, Severe Winter Weather	Medium/ Ongoing
Utilization of water conservation strategies in city ordinances, such as use restrictions in times of drought.	3	2	1.44	1.62	8.06	Drought	High/New
Develop increased protection measures for residential water supplies and systems throughout Blue Earth County.	3	1	1.35	2.08	7.43	Water Supply Contamination	Medium/New
Continue engaging in well head protection best management practices throughout all Blue Earth County communities.	3	2	1.35	2.08	8.43	Water Supply Contamination	High/Ongoing

Mitigation Action	Cost	Funding	Probability	Severity	Total	Hazard	Priority/Status
All Blue Earth County cities should adopt and maintain building and fire codes if they have not already done so.	3	2	1.44	1.47	7.91	Fire	Medium/In Progress
Evaluate and maintain Joint Powers Agreements between fire departments in adjoining communities and between townships and cities.	3	3	1.44	1.47	8.91	Fire	High/Ongoing
Offer classes for residents regarding topics which often lead to fires.	2	2	1.44	1.47	6.91	Fire	Medium/ Ongoing
Require and monitor certified operators and inspections for all public wastewater systems in Blue Earth County.	2	1	1.35	2.08	6.43	Water Supply Contamination	Low/New
Inspect all Blue Earth County dams and reservoirs to ensure structural integrity and safety.	2	2	1.45	1.7	7.15	Infrastructure Failure	Medium/New
Consider increased security measures at government buildings throughout Blue Earth County.	3	2	1	1.68	7.68	Terrorism	Medium/New
Take into consideration the emerging threat of terrorism when designing any new critical facilities.	2	2	1	1.68	6.68	Terrorism	Medium/New
Collaborate with local, state, and federal agencies to maximize efficiency and coordination in the event of a hazard incident.	1	3	1.55	1.6	7.15	All-Hazards	Medium/ Ongoing
Enforce and update all County hazard regulations as needed in order to protect the health, safety, and general welfare of the County	3	2	1.55	1.6	8.15	All-Hazards	High/Ongoing
Provide continual training for emergency response personnel that are likely to be involved with the immediate effects of a hazard event.	1	3	1.55	1.6	7.15	All-Hazards	Medium/ Ongoing
Provide public outreach and education regarding disaster preparedness to all Blue Earth County communities.	2	2	1.55	1.6	7.15	All-Hazards	Medium/ Ongoing
Evaluate funding sources for a countywide camera system for public buildings and infrastructure.	1	1	1	1.68	4.68	Terrorism	Low/New

Mitigation Action	Cost	Funding	Probability	Severity	Total	Hazard	Priority/Status
Seek out funding for the creation of a brochure for the public detailing how to survive for 72 hours on your own in the event of a large scale disaster.	2	1	1.55	1.6	6.15	All-Hazards	Low/New
Evaluate options for a Somali language hotline.	2	1	1.55	1.6	6.15	All-Hazards	Low/New
Ensure County floodplain maps accurately reflect the most up to date data available.	2	2	1.91	1.85	7.76	Flood	Medium/ Ongoing
Seek out funding to bury power lines to critical County facilities.	1	1	1.45	1.7	5.15	Infrastructure Failure	Low/New
Ensure County staffs are prepared for a disease outbreak concerning livestock.	2	2	1.4	1.34	6.74	Animal and Crop Disease	Medium/ Ongoing
Review current zoning ordinances to ensure they are designed to reduce the risk of disease spreading from livestock.	2	2	1.4	1.34	6.74	Animal and Crop Disease	Medium/ Ongoing
Ensure placement of severe weather radios in schools and county buildings.	2	2	1.815	1.945	7.76	Tornado, Severe Summer Weather	Medium/In Progress
Distribute educational material to the public via websites, handouts, and public presentations.	2	2	1.55	1.6	7.15	All-Hazards	Medium/ Ongoing
Create a staff transition plan to ensure that knowledge and expertise of existing staff is carried on to successors.	3	2	1.55	1.6	8.15	All-Hazards	High/New
Provide health education to private businesses where the risks of infectious diseases are a concern.	2	2	1.22	1.52	6.74	Infectious Disease	Medium/ Ongoing
Continue collaborating with the Mayo Health System to encourage participation in vaccination programs for all Blue Earth County residents.	2	3	1.22	1.52	7.74	Infectious Disease	Medium/ Ongoing
Continue reviewing the Emergency Operations Plan to ensure it adequately details the needed steps to respond to all potential hazards.	3	3	1.55	1.6	9.15	All-Hazards	High/Ongoing
Continue to upgrade and improve Emergency Warning Systems.	1	3	1.815	1.945	7.76	Tornado, Severe Summer Weather	Medium/ Ongoing

Mitigation Action	Cost	Funding	Probability	Severity	Total	Hazard	Priority/Status
Encourage development of parks and open space areas along floodplain areas that consistently flood.	1	2	1.91	1.85	6.76	Flood	Medium/New
Provide information on building materials and practices that increase structural safety, and increase energy conservation in cold weather conditions.	2	1	1.44	1.47	5.91	Fire	Low/New
Encourage all agencies to regularly update virus protection software and provide education regarding fraud.	2	2	1.45	1.7	7.15	Infrastructure Failure	Medium/New
Continue strategies for comprehensive backup and securing of electronic data and systems.	1	2	1.45	1.7	6.15	Infrastructure Failure	Low/New
Improve township roads to make them more resistant to flooding	1	2	1.91	1.85	6.76	Flood	Low/New
Ensure township roads are resistant to erosion	1	2	2.01	1.7	6.71	Riverine and Ravine Erosion and Landslides	Low/New
Ensure bridges on township roads are well maintained.	1	2	1.45	1.7	6.15	Infrastructure Failure	Low/New
Conduct rock rip rap along county roads where erosion is a risk such as CSAH 10, CSAH 16, and CSAH 8	1	2	2.01	1.7	6.71	Riverine and Ravine Erosion and Landslides	Medium/New
Purchase new response vehicle for the River Valley Tactical Team	1	1	1	1.68	4.68	Terrorism	Low/New

8.4.2 RATINGS BY ALL CITIES

Mitigation Action	Cost	Funding	Probability	Severity	Total	Priority/Status
Work to decrease strain on city sewers from unofficial sources	1	2	1.91	1.85	6.76	Medium/Ongoing
Improve city infrastructure system to ensure appropriate water volumes are met in all areas of the city	1	2	1.91	1.85	6.76	Medium/In Progress
Ensure that city infrastructure has redundancies in place in the case of power outages during a hazard event	1	2	1.45	1.7	6.15	Low/Ongoing
Ensure that dams and other critical infrastructure are fully functional and structurally sound	1	2	1.45	1.7	6.15	Low/Ongoing
Ensure infrastructure and procedures are in place to provide adequate warning of severe weather events to residents	1	2	1.815	1.945	6.76	Medium/Ongoing
Identify areas at risk of riverine and ravine erosion and landslides and analyze the potential negative effects	1	1	2.01	1.7	5.71	Low/New
Improve city buildings to minimize their susceptibility to hazards	1	1	1.55	1.6	5.15	Low/New
Ensure fire departments have the appropriate building/equipment to fight wildfires.	1	2	1.44	1.47	5.91	Low/New
Train all fire department personnel and other first responders in all Blue Earth county cities in proper hazardous material procedures.	1	1	1.46	1.58	5.04	Low/Ongoing
Utilization of water conservation strategies in city ordinances.	3	2	1.44	1.62	8.06	High/New
Undertake community education and drills to prepare residents for severe weather storm events.	2	2	1.815	1.945	7.76	Medium/Ongoing
Utilization of severe storm spotters network in all Blue Earth County cities.	2	3	1.815	1.945	8.76	High/Ongoing
Create and maintain Mutual Aid Agreements for all Blue Earth County communities.	3	3	1.44	1.47	8.91	High/Ongoing
Utilization of local zoning ordinances to regulate building density, use, bulk, height, and setbacks to assist in preventing fires from jumping from one structure to another.	3	2	1.44	1.47	7.91	Medium/New
Utilize city ordinances to discourage placement of trees near power lines.	3	3	1.445	1.585	9.03	High/New
Ensure cities have appropriate electronic backups of critical data in the event of a cyber attack.	2	1	1	1.68	5.68	Low/New
Find and eliminate sources of inflow and infiltration into the city's water system	1	2	1.91	1.85	6.76	Medium/Ongoing
Update water mains	1	2	1.91	1.85	6.76	Medium/New
Update lift stations	1	2	1.91	1.85	6.76	Medium/New

Mitigation Action	Cost	Funding	Probability	Severity	Total	Priority/Status
The Lake Crystal Dam needs to be replaced	1	1	1.91	1.85	5.76	Low/New
Integrate SCADA system into appropriate city facilities	1	2	1	1.68	5.68	Low/New
Expand existing/Acquire new water tower	1	2	1.44	1.47	5.91	Low/New
Outfit flood station pumps with backup generators	1	2	1.91	1.85	6.76	Medium/In Progress
Reduce stream bank erosion along the Minnesota and Blue Earth Rivers affecting the Land of Memories Campground	1	2	2.01	1.7	6.71	Medium/In Progress
Upgrade water treatment plant	1	2	1.4	1.89	6.29	Low/New
Bury power lines in areas that are susceptible to storm damage	1	2	1.45	1.7	6.15	Low/New
Continue efforts to remove foundation drains from the sanitary sewer system	1	2	1.91	1.85	6.76	Medium/New
Install gutters on city hall and public works buildings	2	2	1.89	1.61	7.5	Medium/New
Install generator at Water Treatment Facility	1	2	1.45	1.7	6.15	Low/New
Remove sources of inflow and infiltration	1	2	1.91	1.85	6.76	Medium/New
Seal manholes on city streets	1	2	1.91	1.85	6.76	Medium/New

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